DOCUMENT RESUME

ED 428 123 TM 029 595

AUTHOR	McCormick, Alexander C.
TITLE	Credit Production and Progress toward the Bachelor's Degree: An Analysis of Postsecondary Transcripts for Beginning Students at 4-Year Institutions. Postsecondary Education Descriptive Analysis Reports.
INSTITUTION	MPR Associates, Berkeley, CA.
SPONS AGENCY	National Center for Education Statistics (ED), Washington, DC.
REPORT NO	NCES-1999-179
ISBN	ISBN-0-16-049927-5
PUB DATE	1999-02-00
NOTE	76p.
AVAILABLE FROM	U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328; U.S. Dept. of Education, ED Pubs, P.O. Box 1398, Jessup, MD 20794-1398; Tel: 1-877-4ED-Pubs (Toll-Free).
PUB TYPE	Numerical/Quantitative Data (110) -- Reports - Evaluative (142)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	Academic Records; *Bachelors Degrees; *College Students; *Credits; *Educational Attainment; *Graduation Requirements; Higher Education
IDENTIFIERS	High School and Beyond (NCES)

ABSTRACT

This report uses postsecondary transcript data for members of the High School and Beyond Sophomore Cohort (students who were sophomores in 1980) to examine progress toward the Bachelor's degree among high school graduates who expected at least a Bachelor's degree, first enrolled at a 4-year institution, and had completed at least 10 semester credits by September 1993. On average, this group, which accounted for 59% of 1980 high school sophomores who had attended a 4-year institution by September 1980, completed about 27 semester hours in their first year. Students enrolled in private, not-for-profit institutions were more likely to complete at least 30 credits. Students' academic preparation and test scores were related to the number of credits they completed in the first year, as was their academic performance in the first year. The number of years students took to cross certain credit thresholds can be used to infer the minimum number of years a student would need to complete a 120- credit Bachelor's degree. Three of four students in the analysis completed a Bachelor's degree, and completion of the degree was more likely for students with higher grade point averages. Other factors related to credit completion are identified. Three appendixes contain reference tables, a glossary, and technical notes and comments on methodology. (Contains 13 tables and 5 figures.) (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

NATIONAL CENTER FOR EDUCATION STATISTICS

Statistical Analysis Report February 1999

Postsecondary Education Descriptive Analysis Reports

Credit Production and Progress Toward the Bachelor's Degree: An Analysis of Postsecondary Transcripts for Beginning Students at 4-Year Institutions

Alexander C. McCormick
MPR Associates, Inc.

C. Dennis Carroll
Project Officer
National Center for Education Statistics

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

U.S. Department of Education
Office of Educational Research and Improvement NCES 1999-179

BEST COPY AVAILABLE

NATIONAL CENTER FOR EDUCATION STATISTICS

Statistical Analysis Report February 1999

Postsecondary Education Descriptive Analysis Reports

Credit Production and Progress Toward the Bachelor's Degree: An Analysis of Postsecondary Transcripts for Beginning Students at 4-Year Institutions

Alexander C. McCormick
MPR Associates, Inc.

C. Dennis Carroll
Project Officer
National Center for Education Statistics

U.S. Department of Education
Office of Educational Research and Improvement NCES 1999-179

U.S. Department of Education
Richard W. Riley
Secretary

Office of Educational Research and Improvement
C. Kent McGuire
Assistant Secretary

National Center for Education Statistics
Pascal D. Forgione, Jr.
Commissioner

The National Center for Education Statistics (NCES) is the primary federal entity for collecting, analyzing, and reporting data related to education in the United States and other nations. It fulfills a congressional mandate to collect, collate, analyze, and report full and complete statistics on the condition of education in the United States; conduct and publish reports and specialized analyses of the meaning and significance of such statistics; assist state and local education agencies in improving their statistical systems; and review and report on education activities in foreign countries.

NCES activities are designed to address high priority education data needs; provide consistent, reliable, complete, and accurate indicators of education status and trends; and report timely, useful, and high quality data to the U.S. Department of Education, the Congress, the states, other education policymakers, practitioners, data users, and the general public.

We strive to make our products available in a variety of formats and in language that is appropriate to a variety of audiences. You, as our customer, are the best judge of our success in communicating information effectively. If you have any comments or suggestions about this or any other NCES product or report, we would like to hear from you. Please direct your comments to:

National Center for Education Statistics
Office of Educational Research and Improvement
U.S. Department of Education
555 New Jersey Avenue NW
Washington, DC 20208–5574

February 1999

The NCES World Wide Web Home Page is
http://nces.ed.gov/pubsearch/index.html

Suggested Citation

U.S. Department of Education. National Center for Education Statistics. *Credit Production and Progress Toward the Bachelor's Degree: An Analysis of Postsecondary Transcripts for Beginning Students at 4-Year Institutions,* NCES 1999–179, by Alexander C. McCormick. Project Officer: C. Dennis Carroll. Washington, DC: 1999.

For ordering information on this report, write:

U.S. Department of Education
ED Pubs
P.O. Box 1398
Jessup, MD 20794–1398

or by calling toll free 1–877–4ED–Pubs.

Content Contact:
Aurora D'Amico
(202) 219–1365

For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328
ISBN 0-16-049927-5

Highlights

Except as noted, all findings reported below apply to a restricted population: high school graduates from the class of 1982 who expected to complete a bachelor's degree or higher, first enrolled at a 4-year institution, and completed at least 10 semester credits at 2- and 4-year institutions by September 1993.[1] This group accounts for 59 percent of 1980 high school sophomores who had attended a 4-year institution by September 1993, and 68 percent of those who had completed a bachelor's degree.[2]

Earned credits reported in this section exclude credits completed while in high school, credits on GED-level transcripts, credits by examination, credits earned at less-than-2-year institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

First-Year Credit Production

- On average, students in the target population completed about 27 semester credits in their first year. Fifty-five percent of students who enrolled at private, not-for-profit institutions completed at least 30 credits, as did 39 percent of those who enrolled at public institutions.
- Students' academic preparation and test scores were related to the number of credits they completed in the first year, as was their academic performance in the first year. For example, about half of those who scored in the top quartile on the HS&B cognitive test completed at least 30 credits, compared with one-third of those with scores in the middle quartiles and one-fifth of those who scored in the bottom quartile.

Credit Thresholds

The number of years students take to cross selected credit thresholds (30, 60, 90, and 120 credits) can be used to infer the minimum number of years that a student may need to complete a 120-credit bachelor's degree (net of other degree requirements). This information opens a window on time to degree.

---

[1]The 10-credit criterion excludes about 3 percent of students who were otherwise eligible for inclusion. A small number of included students graduated in a year other than 1982, but all were high school sophomores in 1980.

[2]U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up (HS&B:80/92), Data Analysis System.

- Almost all students in the analysis (95 percent) earned at least 30 credits. Forty-three percent did so in the first year, and about half (49 percent) earned their 30th credit in the second year. Relatively few (4 percent) took more than 2 years to complete 30 credits.
- The percentage sustaining a 4-year pace was highest at the 30-credit threshold (43 percent), and then remained relatively stable for the subsequent thresholds at 36–38 percent. For each of the 60-, 90-, and 120-unit thresholds, attrition was at least four times more likely among students who reached the previous threshold on a 5-year or slower pace than among those who achieved the previous threshold on a 4-year pace.
- Students who began at public institutions were more likely than their counterparts who began at private, not-for-profit institutions to cross each threshold at a pace implying at least 5 years for degree completion.

Credit and Degree Attainment Outcomes

- Three out of four students in the analysis (76 percent) completed a bachelor's degree (averaging 132 credits). The remaining students were evenly split between those who completed fewer than 60 credits (averaging 37 credits) and those who completed 60 credits or more (averaging 91 credits).
- Academic performance in the first year was strongly correlated with degree completion: the higher a student's first-year GPA, the more likely that student was to have received a bachelor's degree.
- First-year credit production was positively related to total credit production: students who completed fewer than 20 credits in the first year (but at least 10 credits over the period of study) averaged 86 credits overall, while those who completed at least 30 credits in the first year averaged 128 credits over the full period studied. These differences are also reflected in the proportion of students who completed a bachelor's degree: from 45 percent among those with fewer than 20 credits in the first year to 91 percent among those who completed at least 30 credits in the first year.
- Students who interrupted their enrollment (defined as those whose enrollment history includes a gap of two or more semesters, 19 percent of students in the analysis) were half as likely to complete a bachelor's degree as those who were continuously enrolled. Timing of the interruption also made a difference: students who interrupted during or immediately after the first year were least likely to have completed the degree (27 percent), while those who interrupted during or after the third year were most likely to do so (43 percent).

Credit Production Among Bachelor's Degree Completers[3]

- On average, bachelor's degree attainers completed 133 credits.
- Students who attended only 4-year institutions averaged 131 credits, while those who combined attendance at 4-year and less-than-4-year institutions averaged 140 credits; students who received an associate's degree before their bachelor's degree completed an average of 148 credits, compared with 132 credits for those who did not first complete an associate's degree.
- Students who majored in the humanities, social sciences, mathematics and computer science, and business completed fewer credits than average (125–130 credits). Those who majored in engineering and architecture and those who majored in health sciences and services completed more credits than average (145 and 142, respectively).

Analysis of Credit Production After Controlling for Selected Characteristics

- Multiple regression analysis suggests that after controlling for a list of variables used in this report, socioeconomic background, test scores, first-year grades, first-year credit production, and summer term enrollment are all positively related to overall credit production, while initial part-time enrollment and enrollment interruptions are negatively related to credit production.
- Differences in credit production between students who began at public and at private, not-for-profit institutions appear to be related to differences in student characteristics rather than inherent differences between public and private, not-for-profit institutions.
- Delayed entry into higher education does not appear to be related to credit production after controlling for a range of student and enrollment characteristics.

[3]Findings reported in this section are limited to high school graduates who expected to complete a bachelor's degree, but include students who first enrolled at less-than-4-year institutions.

Foreword

This report uses postsecondary transcript data for members of the High School and Beyond (HS&B) Sophomore Cohort (who were high school sophomores when they were sampled in 1980) to examine progress toward the bachelor's degree among high school graduates who expected at least a bachelor's degree, first enrolled at a 4-year institution, and had completed at least 10 semester credits by September 1993. The use of transcripts permits relatively direct examination of progress as measured by the accumulation of credits. Moreover, as unobtrusive measures, transcript data are less error prone than self-reported attendance data. Questions addressed in this study include the following:

- How many credits do bachelor's degree seekers earn in the first year of enrollment, and how does the number of credits vary with student and enrollment characteristics?
- How long do students take to achieve selected threshold levels of credits?
- How is early credit production related to long-term progress and attainment outcomes?
- How many credits do bachelor's degree attainers complete, and how is the number of completed credits related to enrollment characteristics?

The report begins with an analysis of credits completed in the first year. Next, timing to selected credit thresholds is analyzed, followed by an analysis of credit and degree outcomes. For students who completed the bachelor's degree, the number of credits completed is analyzed relative to patterns of enrollment and major field. The report concludes with a statistical analysis of the number of credits completed that isolates the unique relationship between selected variables and credit production.

Acknowledgments

The analysis presented here would not have been possible without the efforts of Clifford Adelman at the U.S. Department of Education, who has invested many hours cleaning, analyzing, and enhancing the Postsecondary Education Transcript Study data as well as producing insightful analyses of those data. In addition, he reviewed preliminary analyses in the early phases of this project as well as drafts of the final report. His thoughtful comments at each stage helped shape and improve the final product.

Ellen Bradburn provided a careful and thorough technical review. The NCES adjudication panel included Clifford Adelman, Robert Burton, Daniel Goldenberg, and Kristin Perry, all of whom contributed valuable feedback and suggestions. As Project Officer for the Postsecondary Education Descriptive Analysis Reports contract under which this report was produced, Dennis Carroll provided guidance and constructive criticism at every stage, from initial topic proposal, through early analyses and preliminary drafts, to the final report.

At MPR Associates, Laura Horn and Susan Choy were constantly supportive throughout this project. Ellen Liebman provided the statistical programming to create the specialized variables used in the analysis. Helen Jang provided all manner of needed assistance. Andrea Livingston edited the text and Karyn Madden provided further editorial support. Barbara Kridl coordinated production of the report, and Don Eike and Francesca Tussing formatted tables, figures, and the final text.

Table of Contents

	Page
Highlights	iii
Foreword	vii
Acknowledgments	viii
List of Tables	xi
List of Figures	xiii
Introduction	1
Analysis Sample	2
Definitions	3
Interpreting Credit Counts	4
Credits Completed in the First Year of Enrollment	7
Academic Preparation, Test Scores, and Achievement	9
Timing of Enrollment	10
Enrollment Intensity	10
When Did Students Achieve Threshold Levels of Credits?	11
Overview	11
Socioeconomic Status, Test Scores, and Academic Achievement	17
Differences by Type of Institution First Attended	17
Changes in Pace at Different Thresholds	18
Credit and Degree Attainment Outcomes	21
Early Credit Production and Other Enrollment Characteristics	23
Where Did Students Earn Their Credits?	27
Credit Production Among Bachelor's Degree Completers	31
Analysis of Credit Production After Controlling for Selected Characteristics	35
Summary and Conclusions	39

Page

Appendix A—Reference Tables 41

Appendix B—Glossary 47

Appendix C—Technical Notes and Methodology 57

List of Tables

Table		Page
1	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to number of credits completed in the first year and the average number of credits, by selected student and enrollment characteristics	8
2	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to year of study when earned 30th credit, by selected student and enrollment characteristics	12
3	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to year of study when earned 60th credit, by selected student and enrollment characteristics	13
4	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to year of study when earned 90th credit, by selected student and enrollment characteristics	14
5	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to year of study when earned 120th credit, by selected student and enrollment characteristics	15
6	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to number of credits completed and bachelor's degree attainment, and the average number of credits, by selected enrollment characteristics	22

Table **Page**

7 Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, average number of credits completed by level of institution, percentage with credits by examination and the average number of credits, and average elapsed time to the bachelor's degree (in months), by selected enrollment characteristics 28

8 Among 1982 high school graduates who expected at least a bachelor's degree and had completed the degree by September 1993, average number of credits completed at qualifying institutions, by selected enrollment characteristics 32

9 Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, the average number of credits completed at qualifying institutions and the adjusted averages after controlling for covariation of the variables listed in the table 36

Appendix Tables

A1 Among 1982 high school graduates who expected at least a bachelor's degree and began at a 4-year institution, percentage distribution according to the number of credits completed at qualifying institutions by 1993 42

A2 Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to type of institution first attended, by selected student and enrollment characteristics 43

A3 Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution (in columns) according to selected student and enrollment characteristics, by type of institution first attended 44

C1 Standard errors corresponding to table 1: Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage distribution according to number of credits completed in the first year and the average number of credits, by selected student and enrollment characteristics 59

List of Figures

Figure		Page
1	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage who completed selected credit thresholds by timing of completion, by first institution type	16
2	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, percentage who completed selected credit thresholds by timing of completion relative to timing of 30th credit	19
3	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions by September 1993, average number of credits completed and the percentage completing a bachelor's degree, by first-year credit production	23
4	Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 30 credits at qualifying institutions by September 1993, percentage distribution according to number of credits completed and bachelor's degree attainment, by timing of 30th credit	24
5	Among 1982 high school graduates who expected at least a bachelor's degree and had completed the degree by September 1993, average number of credits completed at qualifying institutions, by selected enrollment characteristics	34

Introduction

This report uses postsecondary transcript data to examine student progress toward the bachelor's degree.[4] Traditional analyses of persistence and attainment examine self-reported enrollment histories, and two outcomes are typically considered: whether a student has attained, and if not, whether the student is still enrolled. For those still enrolled, the only indicators of progress are duration and continuity of enrollment. Because of variation in enrollment intensity and academic success, however, these are crude measures of progress. The use of transcripts, by contrast, permits relatively direct examination of progress as measured by the accumulation of credits. Moreover, as unobtrusive measures, transcript data are less error prone than self-reported attendance data. Key questions addressed in this study include the following:

- How many credits do bachelor's degree seekers earn in their first year of enrollment, and how does the number of credits earned vary with student and enrollment characteristics?
- How long do students take to achieve selected threshold levels of credits?
- How is early credit production related to long-term progress and attainment outcomes?
- How many credits do bachelor's degree attainers complete, and how is the number of credits related to enrollment characteristics?

The report begins with an analysis of credits completed in the first year. Next, timing to selected credit thresholds is analyzed, followed by an analysis of credit and degree outcomes. For students who completed the bachelor's degree, the number of credits completed is analyzed relative to patterns of enrollment and major field. The report concludes with a statistical analysis of the number of credits completed that isolates the unique relationship between selected variables and credit production.

Tables in the report include student and enrollment characteristics that are related to various aspects of credit production: background characteristics (family socioeconomic status and test scores); high school preparation (whether a student's program included 4 years of English and at least 3 years each of mathematics, science, and social studies); postsecondary enrollment

[4]The analysis is based on a restricted sample: high school graduates who expected to attain at least a bachelor's degree and who first enrolled at a 4-year institution. This group accounts for 59 percent of 1980 high school sophomores who ever enrolled at a 4-year institution, and 68 percent of those who completed a bachelor's degree (U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up [HS&B:80/92], Data Analysis System).

characteristics (timing of enrollment, type of institution first attended, number of credits attempted in the first term, summer term enrollment, and enrollment continuity); and first-year grades. Selected tables also include other relevant characteristics such as the combination of institutions attended, credit production in the first year, undergraduate major, and highest degree as of 1993.

Appendix A includes reference tables that illustrate sample selection, the distribution of students by type of institution first attended, and the distribution of student and enrollment characteristics by type of institution. Appendix B includes a glossary of variable definitions, and appendix C presents technical notes about statistical procedures.

Analysis Sample

Data for the analysis are drawn from the High School and Beyond Postsecondary Education Transcript Study (PETS). High School and Beyond (HS&B) is a longitudinal study of a nationally representative sample of students who were high school sophomores in 1980. Students completed detailed surveys in the base year and in four follow-up surveys between 1982 (when most were high school seniors) and 1992. In addition to the survey data, students took a battery of cognitive tests. Finally, the high school and postsecondary transcripts of sample members were collected and coded. The postsecondary transcript data cover an 11-year period ending in September 1993.[5]

Because this report aims to examine progress among students working on a bachelor's degree and requires full information on credits earned across all institutions attended, the analysis sample was restricted to students who had the following characteristics:

- Graduated from high school;[6]
- Expected to complete a bachelor's degree or higher (when asked in 1982);
- First enrolled at a 4-year institution;
- Had a complete transcript record in PETS (i.e., transcripts were received from each institution attended); and
- Completed at least 10 semester credits at qualifying institutions[7] by 1993.

[5]For more information on the PETS data, see Clifford Adelman, *The New College Course Map and Transcript Files* (Washington D.C.: U.S. Department of Education, 1995).

[6]Students may have graduated at any time. GED recipients were excluded.

[7]For this analysis, "qualifying institutions" include 2- and 4-year institutions (including specialized institutions with Carnegie Classifications 51–59). The 10-credit criterion excludes credits on GED-level transcripts, credits by examination, credit equivalents for clock-hour courses, credits transferred from less-than-2-year institutions, and undocumented transfer credits.

The last restriction, intended to exclude students who had only a brief period of qualifying enrollment that might be characterized as casual enrollment or a "false start," excludes about 3 percent of students who were otherwise eligible for inclusion (appendix table A1).[8] Certain subgroups were disproportionately excluded according to this criterion, reflecting different rates of early attrition. Examples include students from the bottom quartile of family socioeconomic status (SES), those who scored in the bottom quartile on the HS&B cognitive test battery, those who delayed entry into postsecondary education by at least a year, those whose first-year grade point average (GPA) was below 2.0, and those who first enrolled at public nondoctorate-granting institutions (15, 14, 10, 12, and 8 percent excluded, respectively) (appendix table A1).

Not all bachelor's degree seekers begin their postsecondary education at 4-year institutions, and not all undergraduates at 4-year institutions are enrolled for a bachelor's degree. Because the PETS data do not identify students' degree programs, restricting the analysis sample to 4-year beginners with bachelor's degree expectations was deemed to be the most effective way to exclude students who were not working toward a bachelor's degree.[9] This sample includes 59 percent of students who ever attended a 4-year institution, and 68 percent of those who completed a bachelor's degree.[10] One table, which is restricted to bachelor's degree attainers, includes students who did not begin at 4-year institutions for comparison purposes.

Definitions

All members of the target population were high school sophomores in 1980. While this group is identified in tables and figures as 1982 high school graduates, it includes a small number who graduated sometime other than 1982. After applying all restrictions for inclusion set forth above, 99 percent had graduated by 1982.[11]

First institution is based on the PETS variable TRIFA (true institution first attended). This variable identifies the institution where the first "meaningful" attendance after high school took place. It excludes attendance that took place during high school, that consisted only of course withdrawals and drops, and that consisted of only one or two courses (unless that was the only record of attendance). Date of first attendance (used in several tables) is based on the PETS

[8]The 10-credit criterion has been applied in many analyses of postsecondary transcripts. For example, see Clifford Adelman, *Lessons of a Generation: Education and Work in the Lives of the High School Class of 1972* (San Francisco: Jossey-Bass, 1994).

[9]Preliminary analyses included students who began at 2-year as well as 4-year institutions, but the resulting sample was judged to be too heterogeneous with respect to degree intentions. The 10-credit criterion also resulted in a higher rate of exclusion among 2-year beginners.

[10]U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up (HS&B:80/92), Data Analysis System.

[11]Ibid.

variable TRUDATE (true first attendance date), which is the date corresponding to the first term satisfying the criteria for TRIFA.

In calculating credits earned, only undergraduate credits completed at 2- and 4-year institutions (*qualifying institutions*) were counted. Credits earned while in high school, credits on GED-level transcripts, credits by examination, credits that were not earned at qualifying institutions, credit equivalents for courses taught on a clock-hour basis,[12] and credits received after the bachelor's degree were excluded. Transfer credits that were earned at a qualifying institution are counted once, at the institution where the course was taken rather than at the one granting transfer credit. No attempt was made to examine course content: all credit-bearing courses with passing grades were counted. Although institutions use different credit accounting systems, course credits in PETS have been standardized to semester credits.

Some analyses examine the timing of credit accumulation: how long did it take a student to achieve a threshold number of credits? For these analyses, the unit of time is the academic year, and only years with enrollment at qualifying institutions are counted.[13] In other words, time to credit thresholds is a measure of *enrolled* time, not elapsed time. (However, a year is counted equally for students who enrolled for a single term, a 9-month academic year, and a full calendar year.)[14]

Interpreting Credit Counts

Credit counts provide a basic measure of progress through postsecondary education. They offer a perspective on persistence that indicates where nonattainers stand, and they offer a perspective on time to degree that does not limit the analysis to degree attainers. In other words, what does the transcript record tell us about how far students get, and at what pace are they moving toward a degree? That said, it is important to recognize that completing a bachelor's degree requires more than merely accumulating a specified number of credits. Typically, students must also fulfill major and distribution requirements. This aspect of progress is not captured by a simple count of the number of credits completed. A number of circumstances may require students to complete "excess" credits before they can graduate. Students who change their major or

[12]Although clock-hour courses were converted to a standardized semester credit variable in the PETS data (GENCRED), these credits were excluded because of differing institutional practices for counting those credits toward degrees and because these practices also differ widely by field and level of degree program.

[13]Academic years were defined according to term starting dates, with starting dates of June through May constituting an academic year. The transcript data do not include term end dates. Starting dates may have been imputed from more generic transcript notations (e.g., "Spring 1984"), and sometimes varied for a given institution (which may result from idiosyncrasies or changes in an institution's calendar or recording system). Some records associated with a single term appeared to contain more than one term's worth of courses. For these reasons, a more specific measure of enrolled time was not attempted.

[14]Consequently, this measure may overestimate enrolled time for some students and underestimate it for others.

who double-major may complete more than the usual number of credits while fulfilling their major requirements. Transfer can be another source of excess credits: students who transfer may not receive credit for all their previous work, increasing the total number of credits they must take (i.e., credit loss from the student's perspective). Thus, a student may appear to be eligible to graduate on the basis of the credit count, but not yet have completed all degree requirements.

Also, credit counts show the combined effects of enrollment intensity, enrollment duration, and academic success: they reflect the number of courses attempted and passed. However, other factors can influence credit counts. For example, enrolling in courses that carry reduced or no credit (e.g., remedial or developmental courses) may depress credit counts. In addition to enrollment intensity, other factors related to the pattern of enrollment can affect credit production: late starts and enrollment disruptions can depress credit production, while year-round enrollment (i.e., a summer term plus a full academic year) can inflate it.

Credits Completed in the First Year of Enrollment

As noted in the introduction, this report analyzes credit production for a restricted sample: high school graduates who expected to complete at least a bachelor's degree, first enrolled at a 4-year institution, and completed at least 10 credits at qualifying institutions by September 1993. For brevity, this group is hereafter identified as "students in the analysis" or simply as "students" when the sample restriction is already apparent.

Some tables present credit counts in two forms: percentage distribution and average number of credits. Both approaches to summarizing data are useful because averages can conceal distributional characteristics, and apparently trivial differences between averages may be better understood by examining the underlying distributions. In the interest of brevity, however, most of the discussion that follows is framed in terms of averages.

This section presents an analysis of the number of credits completed in the first academic year of enrollment. This excludes enrollment while in high school, false starts, and instances of casual attendance.[15] The operational definition of an academic year was based on term start dates as recorded in the transcript data, with terms starting from June through May constituting an academic year. The vast majority of students in the analysis (95 percent) enrolled within one year of graduation (appendix table A3). Regardless of the year when they first enrolled, about nine out of ten (91 percent) began in the fall (start dates of August through October), 5 percent started earlier, and 3 percent started later (appendix table A3).

On average, students in the analysis completed about 27 semester credits in their first year (table 1). About two students in five (44 percent) completed at least 30 credits.[16] Students who first enrolled at private, not-for-profit 4-year institutions averaged more credits in the first year than those who began at public 4-year institutions (28 versus 26 credits). This apparently small difference may be better understood by examining the percentage who completed at least 30 credits in the first year (55 percent at private, not-for-profit institutions versus 39 percent at public institutions). Some of this difference probably reflects lower rates of full-time attendance at public institutions (as measured by the number of credits attempted in the first year; see appendix table A3).

---

[15]In the PETS data, these exclusions are reflected in the variable identifying "true date of first attendance."

[16]Recall that the sample is limited to students who had completed at least 10 credits by September 1993.

Table 1—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, percentage distribution according to number of credits completed[2] in the first year and the average number of credits, by selected student and enrollment characteristics

	First-year credit production			Average number of credits in first year
	Fewer than 20	20–29.9	30 or more	
Total	15.2	40.9	43.9	26.8
Socioeconomic status as of 1980				
Bottom quartile	23.8	45.6	30.5	24.7
Middle quartiles	18.6	40.2	41.2	26.0
Top quartile	11.4	40.8	47.9	27.7
1982 cognitive test score				
Bottom quartile	40.1	41.8	18.1	21.1
Middle quartiles	19.7	48.0	32.3	25.0
Top quartile	12.1	37.1	50.8	27.9
Rigorous high school curriculum				
Did not meet criteria	16.1	42.2	41.7	26.4
Met criteria	12.5	39.7	47.8	27.5
Time between high school and postsecondary education				
Less than 1 year	13.6	41.0	45.4	27.2
1 year or more	31.8	38.7	29.5	22.8
Month began postsecondary education				
Early start (June–July)	10.8	29.8	59.5	30.1
Regular start (August–October)	12.5	42.8	44.7	27.2
Late start (November-May)	91.8	7.5	0.8	12.0
First institution type				
Public	16.2	45.2	38.6	26.2
Nondoctorate-granting	16.5	46.8	36.7	26.0
Doctorate-granting	16.0	44.0	40.0	26.5
Private, not-for-profit	11.7	33.2	55.2	28.3
Nondoctorate-granting	13.5	31.1	55.4	28.1
Doctorate-granting	7.0	38.2	54.8	28.7
Credits attempted in first term				
Fewer than 12	28.2	42.5	29.3	23.8
12 or more	8.8	40.3	50.9	28.3
First-year grade point average				
Less than 2.0	41.9	50.6	7.5	19.8
2.0–2.49	13.7	55.0	31.3	26.0
2.5–2.99	8.1	39.1	52.9	28.6
3.0–3.49	9.1	31.4	59.6	29.1
3.5 or higher	10.1	17.4	72.5	29.9
Average number of credits in first year	12.8	25.7	32.7	26.8

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

NOTE: Percentages in the first three columns may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

There was a direct relationship between students' SES and the average number of credits completed in the first year: low SES students averaged 25 credits; middle SES students, 26 credits; and high SES students, 28 credits. Again, the percentage who completed at least 30 credits illustrates how this difference in averages is manifested in the distribution: 31 percent of low SES students completed at least 30 credits in the first year, compared with 41 percent of middle SES students and 48 percent of high SES students.[17]

Academic Preparation, Test Scores, and Achievement

Students' academic preparation and test scores were related to the number of credits they completed in the first year, as was their academic performance in the first year. About one out of three students in the analysis pursued a rigorous college-preparatory high school program (defined as 4 years of English plus at least 3 years each of mathematics, science, and social studies) (appendix table A3). This group averaged more credits in the first year than other students. Students with higher scores on the HS&B cognitive test also averaged more credits in the first year. About half (51 percent) of those who scored in the top quartile completed at least 30 credits, compared with about one-third (32 percent) of those with scores in the middle quartiles and about one-fifth (18 percent) of those who scored in the bottom quartile.[18]

Academic success is a factor in credit production: students who fail courses or who drop a course to avoid a failing grade earn fewer credits. This is evident in the relationship between first-year grades and credits earned. Those whose first-year grade point average (GPA) was below 2.5 completed fewer credits than did students with higher grades.[19] Although there is no evidence of a relationship between GPA and average number of credits earned among students who achieved at least a 2.5 GPA, the percentage completing at least 30 credits in the first year was highest among students with GPAs of 3.5 or higher (73 percent, versus 53–60 percent of students with GPAs between 2.5 and 3.5).

[17]Low SES students were also disproportionately excluded by the 10-credit criterion (15 percent were excluded versus no more than 4 percent of other students) (appendix table A1).

[18]Students who scored in the bottom quartile were also disproportionately excluded by the 10-credit criterion.

[19]Students whose first-year GPA was below 2.0 were also disproportionately excluded from the analysis by the 10-credit criterion (appendix table A1).

Timing of Enrollment

Relatively few students in the analysis (5 percent) delayed their entry into postsecondary education by a year or more (appendix table A3). Those who did so averaged fewer credits in the first year.[20]

As one would expect, timing of initial enrollment during the academic year was directly related to the average number of credits completed in the first year: students who began during the summer averaged 30 credits; those who began in the fall averaged 27 credits; and those who began later averaged 12 credits for the year.

Enrollment Intensity

Another element of credit production is enrollment intensity: students who enroll part time complete fewer credits. The number of credits attempted in the first term serves as a reasonable proxy for enrollment intensity.[21] Students who attempted fewer than 12 credits in their first term (about one-third of students in the analysis, appendix table A3) averaged 24 credits for the year, compared with 28 credits among those with higher credit loads in the first term.

[20]In addition to the relationship between delayed enrollment and credit production for students in the analysis, 10 percent of students who delayed enrollment were excluded from the analysis by the 10-credit criterion (appendix table A1).

[21]This is an approximate measure because the "fewer than 12" category can include full-time students at institutions with calendar systems other than the semester system. However, the semester system is the predominant calendar system at the types of institutions included in the analysis.

When Did Students Achieve Threshold Levels of Credits?

In addition to the number of credits earned, it is useful to examine the percentage of students achieving successive threshold credit levels that approximate completion of each year in a traditional 4-year bachelor's degree program: 30, 60, 90, and 120 credits.[22] It is also instructive to examine the number of years of enrollment taken to cross each threshold.[23] This approach opens a window on enrolled time to degree: students can be thought of as sustaining a 4-year pace if they complete 30 credits in 1 year, 60 credits in 2 years, 90 credits in 3 years, or 120 credits in 4 years (i.e., at that rate, they can be expected to complete enough credits for a bachelor's degree after 4 years of enrollment).[24] Students crossing each threshold 1 year later would normally need at least 5 years of enrollment to be eligible for the degree, net of other requirements, while students taking longer would need at least 6 years of enrollment to do so. In the text that follows, these students are identified as being on a 5+ year pace and a 6+ year pace, respectively. These groups are mutually exclusive, and identify the minimum number of years of enrollment that will be required to reach 120 credits if they complete the remaining credits at a rate of 30 per year.

Overview

Of high school graduates who aspired to a bachelor's degree, first enrolled at a 4-year institution, and completed at least 10 credits at qualifying institutions, almost all (95 percent) earned at least 30 credits (table 2). Forty-three percent did so in the first year, and about half (49 percent) earned their 30th credit in the second year.[25] Relatively few (4 percent) took more than 2 years to complete 30 credits.

---

[22]See Paula R. Knepper, *Trends in Postsecondary Credit Production, 1972 and 1980 High School Graduates* (NCES 90-351) (Washington D.C.: U.S. Department of Education, National Center for Education Statistics, 1990).

[23]This is a measure of duration rather than elapsed time because years without enrollment are not counted. Thus a given number of years enrolled does not imply the same number of years elapsed (that is, enrolled years are not necessarily consecutive).

[24]As noted earlier, there are other degree requirements that are not captured by a simple count of credits completed. Also, because credits by examination and certain other credits are excluded, some students who complete less than 120 credits may nonetheless qualify for the degree.

[25]There are small discrepancies between table 1 and table 2. Table 1 is based on credits rounded to the nearest 10th, whereas tables 2–5 report on whether and when a student reached a discrete number of credits. Thus, students who earned 29.95–29.99 credits in the first year are counted as having completed 30 credits in the first year in table 1, but not in table 2.

Table 2—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, percentage distribution according to year of study[2] when earned 30th credit,[3] by selected student and enrollment characteristics

	Did not complete 30 credits	Completed 30 credits			
		Total	First year	Second year	Third year or later
Total	4.7	95.3	43.1	48.5	3.7
Socioeconomic status as of 1980					
Bottom quartile	11.6	88.4	29.5	52.3	6.6
Middle quartiles	8.0	92.0	40.6	46.7	4.7
Top quartile	1.1	98.9	47.0	49.3	2.6
1982 cognitive test score					
Bottom quartile	14.9	85.1	17.3	59.7	8.1
Middle quartiles	7.7	92.3	31.5	55.6	5.2
Top quartile	2.8	97.2	50.0	44.3	2.9
First institution type					
Public	5.6	94.4	37.8	52.4	4.3
Nondoctorate-granting	6.8	93.2	36.1	52.3	4.7
Doctorate-granting	4.6	95.5	39.2	52.4	3.9
Private, not-for-profit	2.9	97.1	54.7	40.3	2.2
Nondoctorate-granting	3.3	96.7	54.7	39.6	2.4
Doctorate-granting	1.9	98.1	54.8	41.9	1.5
First-year grade point average					
Less than 2.0	17.5	82.5	7.3	63.1	12.1
2.0–2.49	5.0	95.0	30.6	62.0	2.5
2.5–2.99	1.5	98.5	51.7	44.7	2.1
3.0–3.49	1.0	99.0	59.0	38.3	1.7
3.5 or higher	1.6	98.4	71.7	25.5	1.2

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Enrolled time (only years with enrollment are counted).

[3]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

NOTE: Details may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Eighty-eight percent of students in the analysis completed at least 60 credits, with 38 percent doing so on a 4-year pace (that is, they crossed the 60-credit threshold by the end of the second year), and 43 percent on a 5+ year pace (table 3). Eighty-one percent completed at least 90 credits, with comparable percentages doing so on a 4-year pace and a 5+ year pace (36 percent) (table 4). Sixty-five percent completed at least 120 credits, 37 percent doing so by the end of the 4th year and 21 percent during the 5th year (table 5). About 1 student in 15 (7 percent) completed 120 credits over 6 or more years of enrollment.

Table 3—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, percentage distribution according to year of study when earned 60th credit,[2] by selected student and enrollment characteristics

	Did not complete 60 credits	Completed 60 credits			
		Total	Second year or earlier	Third year	Fourth year or later
Total	11.9	88.1	37.6	43.2	7.4
Socioeconomic status as of 1980					
Bottom quartile	31.0	69.0	26.4	32.8	9.8
Middle quartiles	16.7	83.3	34.7	41.1	7.5
Top quartile	5.5	94.5	41.3	46.1	7.1
1982 cognitive test score					
Bottom quartile	36.4	63.6	9.4	37.3	16.9
Middle quartiles	18.5	81.6	27.4	44.3	9.8
Top quartile	7.8	92.2	43.7	42.4	6.1
First institution type					
Public	13.9	86.1	32.4	45.0	8.7
Nondoctorate-granting	18.1	81.9	31.8	42.4	7.7
Doctorate-granting	10.6	89.4	32.9	47.2	9.4
Private, not-for-profit	7.4	92.6	49.2	39.0	4.5
Nondoctorate-granting	8.5	91.5	51.5	36.3	3.8
Doctorate-granting	4.7	95.3	43.4	45.7	6.1
First-year grade point average					
Less than 2.0	35.4	64.7	6.3	39.6	18.8
2.0–2.49	14.0	86.0	23.9	53.8	8.2
2.5–2.99	6.1	93.9	40.9	47.9	5.1
3.0–3.49	3.4	96.6	56.6	36.3	3.7
3.5 or higher	3.2	96.8	69.8	24.4	2.7
Year when earned 30th credit[3]					
First year	2.8	97.2	72.3	23.5	1.4
Second year or later	11.5	88.6	12.2	63.3	13.1
Second year	9.5	90.5	13.1	67.5	9.9
Third year or later	37.2	62.8	(4)	8.5	54.3

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[3]Enrolled time (only years with enrollment are counted).

[4]Not applicable.

NOTE: Details may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Table 4—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, percentage distribution according to year of study when earned 90th credit,[2] by selected student and enrollment characteristics

	Did not complete 90 credits	Completed 90 credits[3]			
		Total	Third year or earlier	Fourth year	Fifth year or later
Total	19.0	81.0	35.9	36.1	9.0
Socioeconomic status as of 1980					
Bottom quartile	45.7	54.3	23.7	24.0	6.7
Middle quartiles	22.7	77.3	32.6	36.5	8.2
Top quartile	12.6	87.4	40.1	37.4	9.9
1982 cognitive test score					
Bottom quartile	58.1	41.9	7.1	27.0	7.8
Middle quartiles	31.1	68.9	25.1	32.1	11.7
Top quartile	12.0	88.0	42.5	37.7	7.9
First institution type					
Public	21.5	78.5	30.4	38.0	10.2
Nondoctorate-granting	27.2	72.8	28.2	35.5	9.1
Doctorate-granting	16.9	83.1	32.1	40.0	11.0
Private, not-for-profit	12.5	87.5	48.5	32.6	6.4
Nondoctorate-granting	14.3	85.7	50.3	29.5	5.9
Doctorate-granting	8.2	91.8	44.0	40.1	7.6
First-year grade point average					
Less than 2.0	48.4	51.6	6.0	27.2	18.4
2.0–2.49	24.4	75.6	24.8	38.8	12.0
2.5–2.99	11.5	88.5	40.6	43.1	4.8
3.0–3.49	5.9	94.1	50.6	35.9	7.6
3.5 or higher	4.2	95.8	66.6	26.6	2.6
Year when earned 30th credit[3]					
First year	6.2	93.8	63.0	28.1	2.7
Second year or later	22.4	77.6	16.8	45.9	15.0
Second year	19.6	80.4	18.0	48.9	13.5
Third year or later	58.6	41.4	0	7.0	34.4
Year when earned 60th credit[3]					
Second year or earlier	1.7	98.3	81.7	16.0	0.6
Third year or later	12.9	87.1	10.4	59.4	17.3
Third year	8.6	91.4	12.2	69.1	10.2
Fourth year or later	38.1	62.0	(4)	3.4	58.5

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[3]Enrolled time (only years with enrollment are counted).

[4]Not applicable.

NOTE: Details may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Table 5—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, percentage distribution according to year of study when earned 120th credit,[2] by selected student and enrollment characteristics

	Did not complete 120 credits	Completed 120 credits[3]			
		Total	Fourth year or earlier	Fifth year	Sixth year or later
Total	34.8	65.2	37.2	21.1	6.9
Socioeconomic status as of 1980					
Bottom quartile	56.1	43.9	21.3	16.7	5.9
Middle quartiles	36.0	64.0	33.6	23.9	6.5
Top quartile	30.9	69.1	42.3	19.4	7.4
1982 cognitive test score					
Bottom quartile	63.7	36.3	3.4	26.2	6.8
Middle quartiles	44.6	55.4	28.8	19.0	7.6
Top quartile	29.0	71.0	42.8	21.8	6.4
First institution type					
Public	34.7	65.3	32.5	24.6	8.3
Nondoctorate-granting	37.6	62.4	31.3	23.9	7.3
Doctorate-granting	32.4	67.6	33.5	25.1	9.0
Private, not-for-profit	33.1	66.9	48.3	14.1	4.4
Nondoctorate-granting	31.2	68.8	50.4	13.8	4.7
Doctorate-granting	37.9	62.1	43.3	15.0	3.9
First-year grade point average					
Less than 2.0	60.9	39.1	9.0	16.2	14.0
2.0–2.49	38.3	61.7	29.4	24.3	8.0
2.5–2.99	29.1	70.9	42.0	22.3	6.5
3.0–3.49	25.0	75.1	50.2	20.6	4.3
3.5 or higher	18.9	81.1	60.8	18.3	2.0
Year when earned 30th credit[3]					
First year	18.9	81.1	60.5	17.3	3.3
Second year or later	42.1	58.0	21.2	26.1	10.6
Second year	39.7	60.3	22.7	27.8	9.8
Third year or later	72.8	27.2	1.8	4.5	21.0
Year when earned 60th credit[3]					
Second year or earlier	11.6	88.4	75.3	11.5	1.5
Third year or later	36.7	63.3	17.6	33.1	12.6
Third year	32.3	67.7	20.6	37.7	9.3
Fourth year or later	61.8	38.2	0	6.7	31.5
Year when earned 90th credit[3]					
Third year or earlier	7.2	92.8	85.7	6.8	0.4
Fourth year or later	29.2	70.8	14.3	41.4	15.1
Fourth year	27.5	72.6	17.8	48.7	6.0
Fifth year or later	36.1	63.9	(4)	12.3	51.6

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[3]Enrolled time (only years with enrollment are counted).

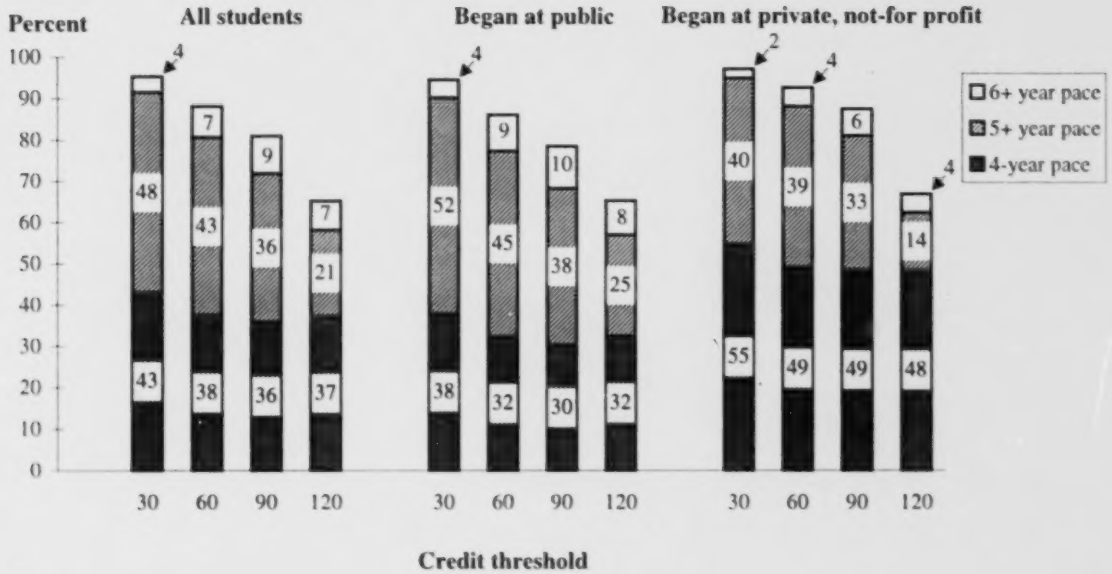
[4]Not applicable.

NOTE: Details may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

The percentage of students sustaining a 4-year pace was highest at the 30-credit threshold (43 percent), and then remained relatively stable for the subsequent thresholds at 36–38 percent (figure 1). For each of the 60-, 90-, and 120-unit thresholds, attrition was at least four times more likely among students who reached the previous threshold on a 5+ year pace or slower than among those who did so on a 4-year pace (tables 3–5).[26]

Figure 1—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits[1] at qualifying institutions[2] by September 1993, percentage who completed selected credit thresholds by timing of completion, by first institution type



[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

NOTE: Four-year pace = Completion of 30th credit in year 1, 60th in year 2, 90th in year 3, 120th in year 4. Five+ year pace = Completion of 30th credit in year 2, 60th in year 3, 90th in year 4, 120th in year 5. Six+ year pace = Completion of 30th credit after year 2, 60th after year 3, 90th after year 4, 120th after year 5. Years refer to enrolled time (only years with enrollment are counted).

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

[26]As used here, "attrition" is not equivalent to dropping out because it includes students who completed subbaccalaureate awards (from 4-year or less-than-4-year institutions).

Socioeconomic Status, Test Scores, and Academic Achievement

Paralleling the findings for credits completed in the first year, the likelihood that students would reach each threshold was systematically related to their SES and their performance on the HS&B cognitive test: at successive levels of SES and at successive levels of test performance, students were more likely to reach each threshold.

Similarly, academic performance in the first year was related to the likelihood that a student would reach each threshold. For example, students whose first-year GPA was below 2.0 were less likely than others to reach the 30-credit threshold (table 2).[27] They were also much more likely than other students to take at least 3 years to do so (12 percent, versus 1–3 percent of students with higher first-year grades).

Differences by Type of Institution First Attended

Students frequently attend more than one institution. Some students transfer, while others temporarily enroll elsewhere and then return to the "home" institution, and still others enroll simultaneously at more than one institution. Although comparisons are made below according to the type of institution first attended, it is important to recognize that students who began at a certain type of institution did not necessarily cross credit thresholds at the same institution where they began or at the same type of institution.

Students who began at private, not-for-profit 4-year institutions were more likely than those who began at public ones to reach the 30-, 60-, and 90-unit thresholds, but the two groups were equally likely to reach 120 credits. (Bachelor's degree recipients who began at private not-for-profit institutions were more likely than those who began at public institutions to graduate with fewer than 120 credits, exclusive of credits by examination.)[28]

There were also differences with respect to the amount of time students took to cross each threshold. For example, students who began at public institutions were more likely than their counterparts who began at private, not-for-profit institutions to cross each threshold on a 5+ year pace or slower (last two columns in tables 2–5).

---

[27]Recall that the analysis sample is restricted to those who completed at least 10 credits at qualifying institutions, and that students whose first-year GPA was below 2.0 were less likely than other students to be included in the sample at all (appendix table A1). Thus, this analysis understates the *overall* effect of low first-year grades.

[28]U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up (HS&B:80/92), Data Analysis System.

On the other hand, there were few systematic differences between students who began at doctorate-granting and nondoctorate-granting institutions in reaching each threshold. A noteworthy exception is that students who began at doctorate-granting institutions were more likely than those who began at nondoctorate-granting institutions to complete at least 90 credits. There is insufficient evidence of any difference at the 120-credit threshold, however.

Changes in Pace at Different Thresholds

Despite the fact that the overall percentage of students on a 4-year pace from the 60-credit threshold on remained relatively stable, an appreciable number of students accelerated or decelerated their pace between thresholds. Accelerating the pace between thresholds amounts to crossing two thresholds in e same year. For example, a student who completed the 30th credit early in the second year of enrollment and then went on to cross the 60-credit threshold in the same year was on a 5+ year pace at 30 credits, but a 4-year pace at 60 credits.

Among those who were on a 4-year pace through the 30th credit, about one in four slowed their pace by the 60th credit (table 3). Two-thirds of those on a 5+ year pace at the 30th credit sustained that pace through 60 credits; 13 percent accelerated to a 4-year pace; and 10 percent had slowed their pace by the 60th credit.

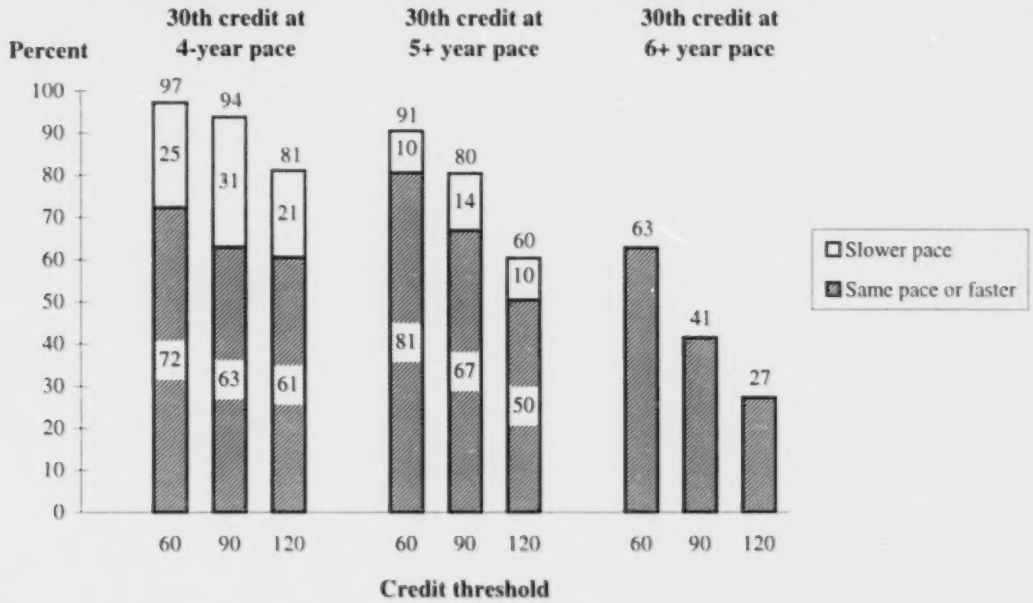
About four out of five students who were on the 4-year pace at 60 credits sustained that pace through 90 credits, while 16 percent slowed to a 5+ year pace (table 4). Twelve percent of those who completed 60 credits on a 5+ year pace were on a 4-year pace at 90 credits; 69 percent maintained the 5+ year pace; and 10 percent shifted to a slower pace.

Among students who completed 90 credits on a 4-year pace, 86 percent maintained that pace through 120 credits and 7 percent slowed to a 5+ year pace (table 5). Of those who were on a 5+ year pace through 90 credits, 18 percent were on a 4-year pace at 120 credits, about half (49 percent) sustained the 5+ year pace; and 6 percent completed their 120th credit at a slower pace.

Figure 2 presents these data in a slightly different way: it shows the proportion of students who reached the 60-, 90-, and 120-credit thresholds relative to their pace at 30 credits. It also shows the proportion who sustained or accelerated that pace at the subsequent thresholds (dark areas) and the proportion who completed those thresholds at a slower pace (light areas). Steady attrition is evident at each level, but the decline is less steep among those who completed the 30th credit in the first year. Attrition is most pronounced among students who took three or more

years to complete 30 credits: they were about half as likely as students who completed their 30th credit on a 5+ year pace eventually to reach 90 or 120 credits.[29]

Figure 2—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits[1] at qualifying institutions[2] by September 1993, percentage who completed selected credit thresholds by timing of completion relative to timing of 30th credit



[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

NOTE: Four-year pace = Completion of 30th credit in year 1, 60th in year 2, 90th in year 3, 120th in year 4. Five+ year pace = Completion of 30th credit in year 2, 60th in year 3, 90th in year 4, 120th in year 5. Six+ year pace = Completion of 30th credit after year 2, 60th after year 3, 90th after year 4, 120th after year 5. Years refer to enrolled time (only years with enrollment are counted). Same pace or faster = Subsequent credits were completed at the same pace as the 30th credit, or faster. Slower pace = Subsequent credits were completed at a slower pace than the 30th credit (applies only to students who completed the 30th credit at 4- or 5+ year pace). Details may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

[29]There may be some time-censoring effects because the data cover an 11-year period. If students enrolled promptly after high school, steadily earned 30 credits every 3 years, and did not interrupt their enrollment, there is enough time to observe the 90th credit but not the 120th credit. If students delayed their initial enrollment, took more than 3 years for every 30 credits, or interrupted their enrollment, the time period may not be long enough to observe the 90th credit.

Figure 2 also shows that many students who crossed the 30-credit threshold on a 4-year pace had reduced their pace by subsequent thresholds. Indeed, they were twice as likely to slow their pace as students who completed 30 credits on a 5+ year pace.

Credit and Degree Attainment Outcomes

How many students in the analysis completed bachelor's degrees, and of those who did not, how far had they progressed? Table 6 informs this question by combining information about bachelor's degree attainment with information about the number of credits completed at qualifying institutions. The table also includes a column displaying the average number of credits completed. Because bachelor's degree attainers completed more credits than other students, categories of students that have a higher percentage of bachelor's degree attainers also have a higher average number of credits.

Readers are reminded that because of the way the analysis sample was defined, about one-third of bachelor's degree attainers (32 percent) were excluded from this analysis because they did not graduate from high school, did not have bachelor's degree expectations when they were in high school, or first enrolled at a less-than-4-year institution.

Among high school graduates who expected at least a bachelor's degree, first enrolled at a 4-year institution, and completed at least 10 credits, three out of four (76 percent) completed a bachelor's degree (averaging 132 credits). The remaining students were evenly split between those who completed fewer than 60 credits (averaging 37 credits) and those who completed 60 credits or more (averaging 91 credits) (table 6). Some students in these two groups received sub-baccalaureate credentials: of those who completed fewer than 60 credits, 2 percent completed a certificate and a very small proportion (0.2 percent) completed an associate's degree; of those who completed at least 60 credits but no bachelor's degree, 3 percent completed a certificate and 20 percent completed an associate's degree.[30]

Students who first enrolled at private, not-for-profit institutions were more likely than those who began at public institutions to have completed a bachelor's degree (83 versus 73 percent). Within each of these categories, students who began at doctorate-granting institutions were more likely than others to complete the degree.

Academic performance in the first year was strongly correlated with degree completion: the higher a student's first-year GPA, the more likely that student was to have received a bachelor's degree.

---

[30]U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up (HS&B:80/92), Data Analysis System.

Table 6—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, percentage distribution according to number of credits completed[2] and bachelor's degree attainment, and the average number of credits, by selected enrollment characteristics

		60 credits or more			
	Fewer than 60 credits	Total	Did not receive bachelor's degree	Received bachelor's degree	Average number of credits
Total	11.9	88.1	12.0	76.2	115.5
First institution type					
Public	13.9	86.1	13.0	73.1	114.4
Nondoctorate-granting	18.1	81.9	14.5	67.4	110.1
Doctorate-granting	10.6	89.4	11.7	77.7	117.8
Private, not-for-profit	7.4	92.6	9.9	82.7	118.9
Nondoctorate-granting	8.5	91.5	11.1	80.5	117.9
Doctorate-granting	4.7	95.3	7.0	88.3	121.4
First-year grade point average					
Less than 2.0	35.4	64.7	22.9	41.8	88.2
2.0–2.49	14.0	86.0	17.4	68.6	111.7
2.5–2.99	6.1	93.9	9.9	84.0	122.1
3.0–3.49	3.4	96.6	4.9	91.7	127.4
3.5 or higher	3.2	96.8	2.7	94.1	126.7
First-year credit production					
Fewer than 20	35.6	64.4	19.4	45.0	85.7
20–29.9	12.8	87.2	15.1	72.1	113.5
30 or more[3]	2.8	97.2	6.5	90.8	127.7
Year when earned 30th credit[4]					
First year	2.8	97.2	6.1	91.1	127.9
Second year or later	11.5	88.6	17.9	70.7	113.8
Second year	9.5	90.5	16.6	74.0	115.9
Third year or later	37.2	62.8	34.9	27.9	85.6
Enrollment continuity					
Continuous enrollment	8.1	91.9	7.7	84.2	120.1
Interrupted enrollment	27.9	72.1	30.5	41.7	96.0
Timing of enrollment interruption[5]					
Year 1	47.1	52.9	26.1	26.8	75.2
Year 2	34.5	65.5	28.3	37.2	90.5
Year 3 or later	12.6	87.4	44.1	43.3	108.8
Summer term enrollment					
None	22.8	77.2	10.2	67.0	101.5
1 or more	5.5	94.5	13.0	81.5	123.6
Average number of credits	36.5	126.2	91.0	131.7	115.5

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[3]Due to rounding, includes a small number of students who completed 29.95–29.99 credits.

[4]Enrolled time (only years with enrollment are counted).

[5]Enrolled time (only years with enrollment are counted). Limited to students for whom the interruption was observed at a qualifying institution and who subsequently returned to a qualifying institution.

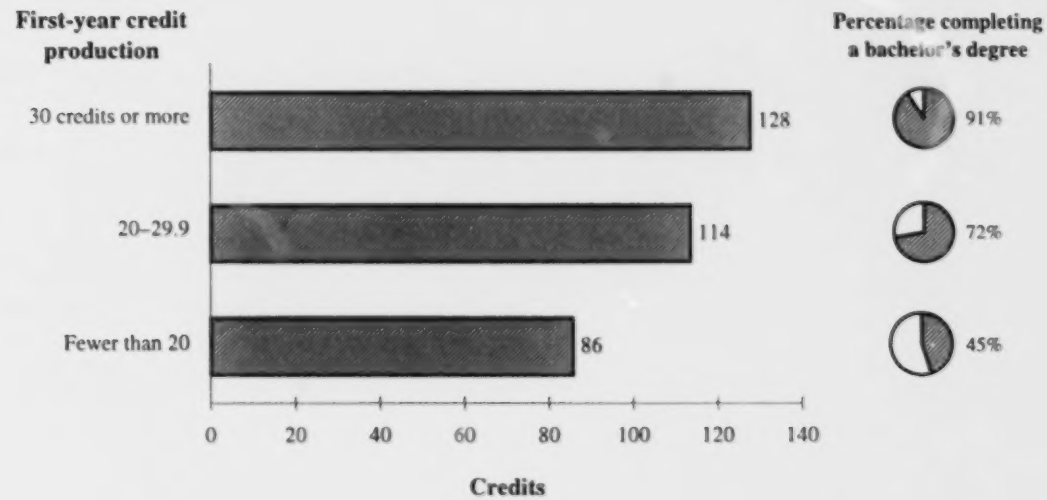
NOTE: Percentages in the first four columns may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Early Credit Production and Other Enrollment Characteristics

First-year credit production was positively related to total credit production: students who completed fewer than 20 credits in the first year (but at least 10 credits over the period of study) averaged 86 credits overall, while those who completed at least 30 credits in the first year averaged 128 credits over the full period studied (figure 3). These differences are also reflected in the proportion of students who completed a bachelor's degree: from 45 percent among those with fewer than 20 credits in the first year to 91 percent among those who completed 30 credits in the first year.

Figure 3—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits[1] at qualifying institutions[2] by September 1993, average number of credits completed and the percentage completing a bachelor's degree, by first-year credit production

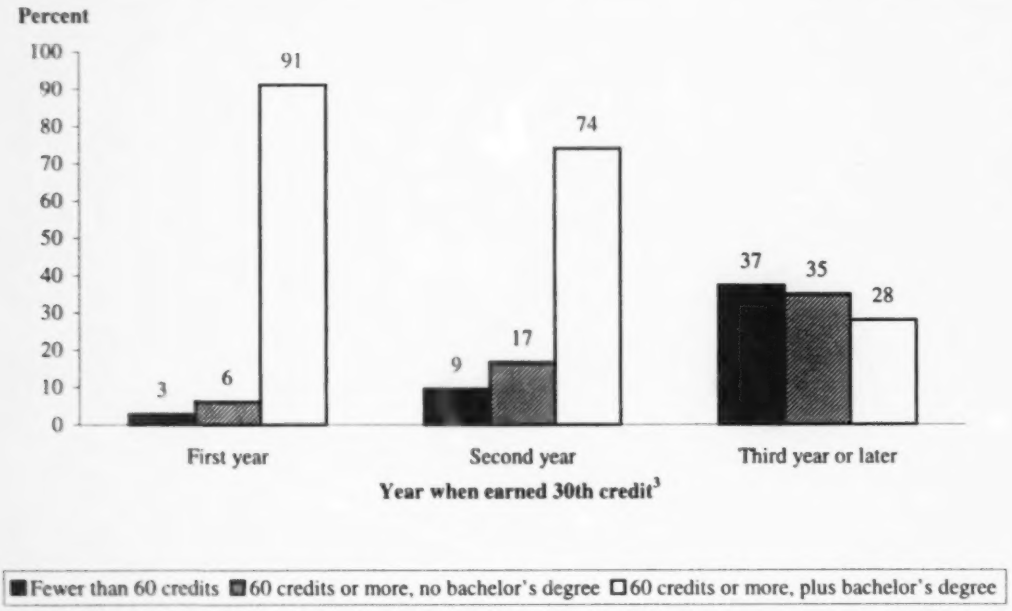


[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.
[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Among students who completed at least 30 credits, credit and attainment outcomes were related to the number of years they took to complete the credits (figure 4). Nine out of ten students who reached the 30-credit threshold in the first year completed a bachelor's degree, compared with about three-quarters of those who did so in the second year and 28 percent of those who took longer to complete 30 credits.[31] Those who took at least 3 years to reach their 30th credit were much more likely than the others to have completed fewer than 60 credits (37 percent, versus 3–9 percent of students who completed 30 credits in 1 or 2 years).

Figure 4—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 30 credits[1] at qualifying institutions[2] by September 1993, percentage distribution according to number of credits completed and bachelor's degree attainment, by timing of 30th credit



[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.
[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).
[3]Enrolled time (only years with enrollment are counted).

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

[31]The issues of time censoring examined in the earlier discussion of credit thresholds apply here, as well.

Summer term enrollment was positively related to bachelor's degree completion: students who enrolled for at least one summer term (63 percent of students in the analysis, appendix table A3) were more likely than others to complete a bachelor's degree (82 versus 67 percent). This difference may reflect two phenomena: students who enrolled for one or more summer terms to accelerate their program, and students who needed one extra term to complete degree requirements and whose only summer term was their last undergraduate term.

Students who interrupted their enrollment (defined as those whose enrollment history includes a gap of two or more semesters, 19 percent of students in the analysis) were half as likely to complete a bachelor's degree as those who were continuously enrolled. The timing of the interruption also made a difference: students who interrupted during or immediately after the first year were least likely to have completed the degree (27 percent), while those who interrupted during or after the third year were most likely to do so (43 percent). This is consistent with previous research findings.[32]

[32]See Laura J. Horn, *Nontraditional Undergraduates: Trends in Enrollment from 1986 to 1992 and Persistence and Attainment Among 1989–90 Beginning Postsecondary Students* (NCES 97–578) (Washington, D.C.: U.S. Department of Education, National Center for Education Statistics, 1996).

Where Did Students Earn Their Credits?

Although this analysis is restricted to students who first enrolled at 4-year institutions, not all credits were necessarily earned at such institutions. For instance, some students took courses at 2-year institutions (including those who were concurrently enrolled at 2- and 4-year institutions, those who temporarily enrolled at 2-year institutions, and those who transferred to 2-year institutions). In addition, some students received credits by examination (not included in the counts of completed credits). This section briefly examines where students received their credits, and how many credits they received.

Students in the analysis averaged 116 credits at qualifying institutions, and 112 credits at 4-year institutions. Fifteen percent earned credits at 2-year institutions, averaging 23 credits, and 4 percent earned credits by examination, averaging 10 such credits[33] (table 7).

Students who began at public institutions were more likely than those who began at private, not-for-profit institutions to have earned credits at 2-year colleges (17 versus 11 percent). Within each category of institutional control, credits from a 2-year college appeared more often on the transcript records of students who began at a doctorate-granting institution.

The number and source of credits varied among students who had attained degrees. Students whose highest degree was an associate's degree averaged 98 credits overall and 59 credits at 4-year institutions. (Some of these credits may have been taken after the associate's degree.) Three-quarters of this group (76 percent) had earned credits at 2-year institutions, averaging 54 credits. Bachelor's degree attainers averaged 132 credits overall, and 130 credits at 4-year institutions. Ten percent had earned credits from 2-year institutions, averaging 18 credits.[34]

Among bachelor's degree attainers, about four and a half years (53 months) passed between the date of first enrollment and receipt of the bachelor's degree.[35] Students who began at public institutions averaged 55 months elapsed time to degree, while those who began at private, not-for-profit institutions averaged 50 months (or slightly more than 4 full years).[36]

---

[33]Credits by examination are not included in other credit totals.

[34]Among all bachelor's degree completers (including community college transfers), 24 percent had credits from 2-year college, averaging 46 credits (U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up [HS&B:80/92], Data Analysis System).

[35]Unlike other measures of time used in this report, this is a measure of elapsed time, not enrolled time.

[36]Degree completion in four consecutive years on a traditional academic calendar (from the fall term of year 1 through the spring term of year 4) equates to about 45 months in elapsed time.

Table 7—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, average number of credits completed by level of institution,[2] percentage with credits by examination and the average number of credits, and average elapsed time to the bachelor's degree (in months), by selected enrollment characteristics

	Credits completed						
	At qualifying institutions (average)	At 4-year institutions (average)	At 2-year institutions (percentage)	At 2-year institutions (average)[3]	Credits by exam (percentage)	Credits by exam (average)[3]	Number of months to bachelor's
Total	115.5	112.1	15.4	23.3	3.9	9.9	53.4
First institution type							
Public	114.4	110.5	17.3	23.2	3.2	9.1	55.0
Nondoctorate-granting	110.1	106.3	15.3	25.1	1.0	—	54.9
Doctorate-granting	117.8	113.8	19.0	21.9	5.1	9.6	55.1
Private not-for-profit	118.9	116.8	10.9	19.4	5.4	10.9	49.9
Nondoctorate-granting	117.9	115.8	9.7	21.3	4.5	—	49.7
Doctorate-granting	121.4	119.3	13.7	16.0	7.4	—	50.3
Highest degree as of 1993							
None or certificate	59.8	54.0	28.3	20.7	1.9	—	(4)
Associate's	97.6	58.6	75.8	54.2	0.8	—	(4)
Bachelor's or higher	131.6	129.9	9.8	17.6	4.5	10.2	53.4
Summer term enrollment							
None	101.5	99.4	9.9	23.1	2.9	—	49.5
1 or more	123.6	119.4	18.5	23.3	4.5	9.6	55.2
Credits by examination							
Did not receive	115.2	111.7	15.5	23.7	(4)	(4)	53.5
Received	123.6	122.1	13.1	—	100.0	9.9	50.2

—Too few cases for a reliable estimate.

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[3]Among those with any such credits.

[4]Not applicable.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Students who enrolled for at least one summer term completed more credits, on average, than did students with no summer enrollment. They were also more likely to have taken courses at a 2-year college (19 percent did so, versus 10 percent of students who did not enroll during the summer). Although summer term enrollment may be thought of as a way for students to

accelerate their progress, the data on elapsed time to degree do not bear this out: students who enrolled for at least one summer term took about 6 months longer from initial enrollment to degree completion than did students who did not attend during the summer. Several possibilities may explain this finding. The group who enrolled during the summer may contain disproportionate numbers of the following types of students: those who enrolled for additional terms to make up for part-time enrollment; those who enrolled for additional terms to make up for credit shortfalls due to dropped or failed courses; those who stopped out (which would inflate elapsed time to degree); and those who enrolled for an additional term at the end of their undergraduate career to complete needed credits. The transcript data support all of these accounts: students who enrolled for at least one summer term were less likely than others to have taken at least 12 credits in their first term; they were less likely than others to have completed at least 30 credits in the first year; they were less likely than others to have a first-year GPA of at least 2.0; they were more likely than others to have interrupted their enrollment; and they were more likely than others to have ended their undergraduate careers in a summer or fall term.[37]

About 5 percent of bachelor's degree attainers received credits by examination, averaging 10 credits. On average, these students received the bachelor's degree about 3 months sooner than those who did not receive credits by examination.

[37]U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up (HS&B:80/92), Data Analysis System.

Credit Production Among Bachelor's Degree Completers

This section differs from previous sections in two important respects. First, the analysis is restricted to bachelor's degree recipients. Second, because of this restriction, it is appropriate to broaden the analysis to include students who first enrolled at less-than-4-year institutions. Other sample restrictions (high school graduates who expected at least a bachelor's degree and completed at least 10 credits at qualifying institutions) still apply.[38]

On average, students who attained a bachelor's degree completed 133 credits (table 8).[39] There is considerable variation in the number of credits completed when examined relative to students' patterns of attendance and major field. Students who attended only 4-year institutions averaged 131 credits, while those who combined attendance at 4-year and less-than-4-year institutions averaged 140 credits.[40]

Bachelor's degree attainers who began their postsecondary education at public 2-year institutions averaged about 10 credits more than their counterparts who began at 4-year institutions (142 credits, compared with 130 credits among those who began at private, not-for-profit 4-year institutions and 134 credits among those who began at public 4-year institutions). Among students who began at 4-year institutions, those who first enrolled at public institutions averaged about 4 more credits than those who began at private, not-for-profit institutions, a difference which persists when the comparison is limited to those who attended only 4-year institutions. Students who began at public doctorate-granting institutions averaged fewer credits than those who began at public nondoctorate-granting institutions, but there is no evidence of a comparable difference among students who began at private institutions.

Students who received an associate's degree before their bachelor's degree completed an average of 148 credits, compared with 132 credits for those who did not first complete an

---

[38]Among bachelor's degree completers, virtually all (99.6 percent) were high school graduates, and 83 percent expected at least a bachelor's degree (U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up [HS&B:80/92], Data Analysis System).

[39]Recall that credit counts exclude credits by examination and transfer credits that were not earned at qualifying institutions. Thus, the total number of credits is slightly higher. The averages reported in tables 7 and 8 differ because table 7 is restricted to students who began at a 4-year institution, while table 8 is not.

[40]The latter group includes students who began at 2-year institutions and students who began at 4-year institutions. The average number of credits completed by bachelor's degree attainers who attended a 2-year and then a 4-year institution was also 140 credits (U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up [HS&B:80/92], Data Analysis System).

Table 8—Among 1982 high school graduates who expected at least a bachelor's degree and had completed the degree by September 1993, average number of credits completed[1] at qualifying institutions,[2] by selected enrollment characteristics

		Combination of institutions attended	
	Total	4-year institution(s) only	All other combinations
Total	132.9	131.3	140.0
First institution type[3]			
Public 4-year	133.7	133.1	141.2
Nondoctorate-granting	135.1	134.7	141.2
Doctorate-granting	132.6	132.0	141.2
Private, not-for-profit 4-year	129.8	129.3	141.1
Nondoctorate-granting	130.3	130.3	131.8
Doctorate-granting	128.6	126.9	—
Public 2-year	142.3	([4])	142.3
Combination of postsecondary awards			
Associate's, then bachelor's	147.8	—	148.3
Bachelor's, no prior associate's	131.8	131.3	135.4
Major field			
Business	130.4	129.1	138.3
Education and library science	135.5	135.7	—
Engineering/Engineering technology/ Architecture	145.1	142.0	161.2
Physical sciences	130.0	130.0	—
Mathematics/Computer science	129.0	129.2	—
Life sciences	133.8	133.0	—
Health sciences/Services	141.5	137.9	—
Humanities	124.8	124.4	—
Arts/Applied arts	132.4	129.8	—
Social sciences	124.6	124.1	128.4
Applied social sciences	130.4	129.1	136.3
Other	142.3	—	142.3
Combination	136.3	136.5	—
Credits by examination			
Did not receive	133.3	131.7	140.1
Received	125.5	124.2	—

—Too few cases for a reliable estimate.

[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[3]Excludes a small number of students who began at private, not-for-profit less-than-4-year institutions (too few for reliable estimates).

[4]Not applicable.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

associate's degree. The difference persists when students who attended only 4-year institutions are excluded from the comparison (148 versus 135 credits).[41] This difference corresponds roughly to one additional semester of full-time enrollment for students who completed both degrees.

Students who received any credits by examination completed fewer credits than those who did not receive examination credits (the average number of credits completed excludes examination credits). This suggests that students may substitute examination credits for credits that they would otherwise earn while enrolled. Alternatively, they may have simply taken fewer elective courses, have elected majors with fewer requirements, or have a lesser propensity to change majors.

Comparing the number of credits completed by major field also reveals some striking differences (figure 5). Students who majored in the humanities, social sciences, mathematics and computer science, and business completed fewer credits than average (125–130 credits). In contrast, students who majored in engineering and architecture and those who majored in health sciences and services completed more than the average number of credits (145 and 141, respectively). Students who majored in fields not categorized ("Other" in table 8 and figure 5) also completed more than the average number of credits.

When these comparisons are restricted to students who attended only 4-year institutions, those in the following majors completed fewer credits than the average bachelor's degree recipient: humanities, social sciences, and business (124–129 credits). Majors who completed more credits than average for students who attended only 4-year institutions include engineering and architecture, health sciences and services, and those whose transcripts indicated more than one field of study[42] (136–142 credits).

Students majoring in engineering and architecture consistently completed more credits than average: 142 credits among students who attended only 4-year institutions and 161 credits among those who attended both 4-year and less-than 4-year institutions. This is partly due to different degree requirements: some undergraduate engineering and architecture programs are 5-year programs.[43]

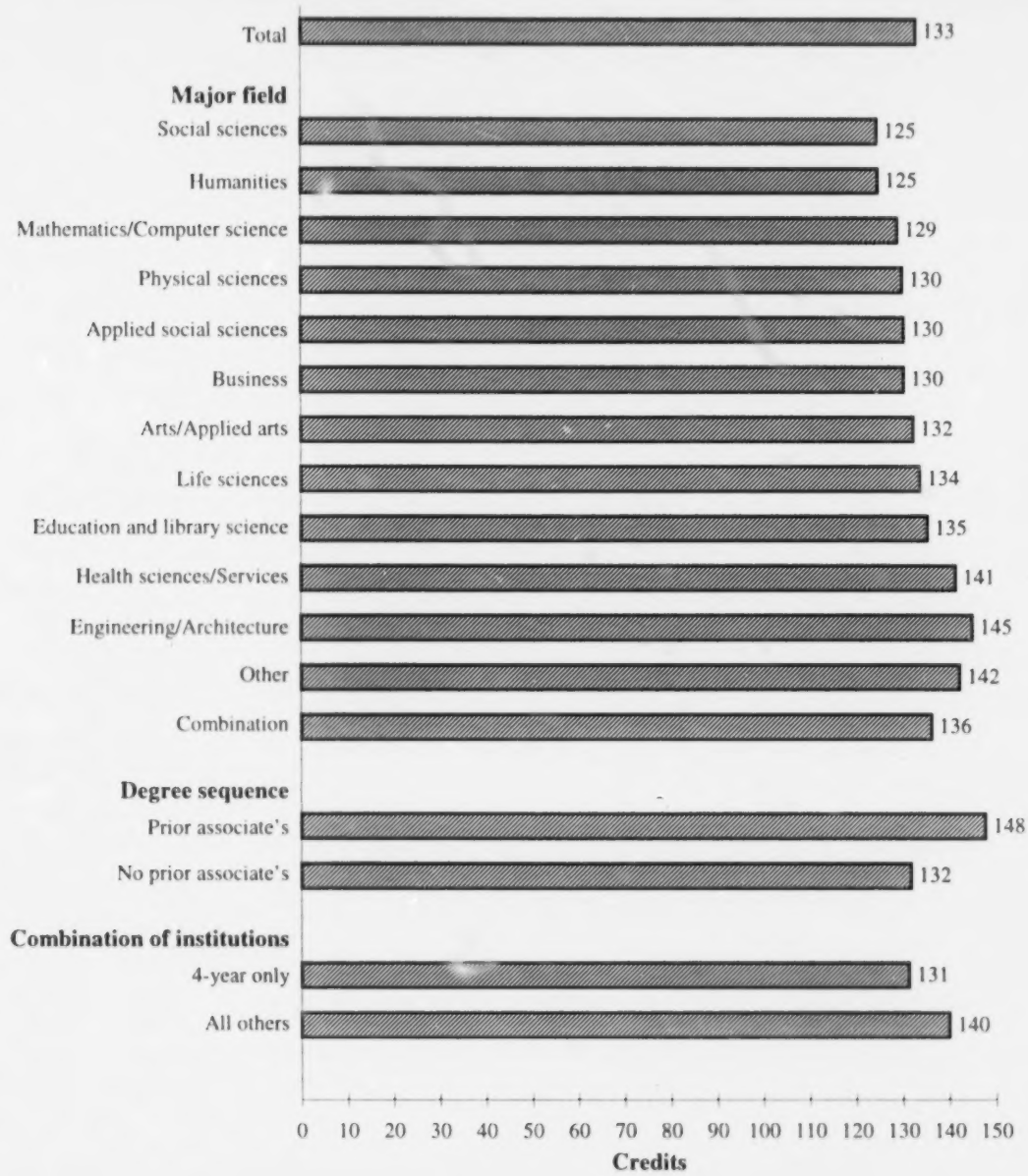
---

[41]Associate's degrees may have been awarded by 2- or 4-year institutions. Among bachelor's degree attainers who attended a 2-year and then a 4-year institution, those who first attained an associate's degree averaged 144 credits, while others averaged 136 credits (U.S. Department of Education, National Center for Education Statistics, High School and Beyond Longitudinal Study Fourth Follow-up [HS&B:80/92], Data Analysis System).

[42]This group includes students with a minor, a double major, or some other combination of fields.

[43]This does not include combined undergraduate and graduate programs because credits completed after the bachelor's degree are not included in totals.

Figure 5—Among 1982 high school graduates who expected at least a bachelor's degree and had completed the degree by September 1993, average number of credits[1] completed at qualifying institutions,[2] by selected enrollment characteristics



[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Analysis of Credit Production After Controlling for Selected Characteristics

Thus far, the analysis has examined the relationship between credit production and individual student or enrollment characteristics, considering each characteristic separately. Because these characteristics are related to one another—for example, high SES students are more likely than other students to have had a rigorous high school curriculum and to have high test scores—this approach does not reveal the *unique* relationship between each characteristic and credit production (that is, the relationship that exists apart from the confounding influence of other variables). The following analysis uses multiple linear regression techniques to provide information about how certain characteristics are related to credit production after controlling for some of the other characteristics examined in this report. For more information about this methodology, refer to appendix C.

Table 9 presents the results for a regression analysis of the average number of credits completed. As with all other tables in the text of this report except table 8, the analysis is limited to high school graduates who expected at least a bachelor's degree, first enrolled at a 4-year institution, and completed at least 10 credits at qualifying institutions. The first column of numbers contains the unadjusted averages—that is, the averages before controlling for the other variables. The second column contains the averages after adjusting for covariation among the variables in the table (that is, holding the other variables constant). For each row variable in the table, the category in italics is the reference category for comparisons and tests of statistical significance. Numbers with asterisks in the first and second columns indicate that the average number of credits for students in that category is significantly different than that of the reference category. Rows containing an asterisk in only one of these columns indicate cases where the adjustment procedure leads to a different conclusion than one would reach based on the unadjusted averages. Consider the rows for socioeconomic status: the first column shows that low SES students averaged 94 credits, less than the 112 credits completed by middle SES students. The second column indicates that after controlling for the other variables in the table, low SES students averaged 102 credits and middle SES students averaged 114 credits.[44] In this case, the model does not alter the conclusion: low SES students still averaged fewer credits than middle SES students.

[44]The adjusted averages are the averages for low- and middle-SES students who share identical values on the other variables in the table (see appendix C).

Table 9—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, the average number of credits completed[2] at qualifying institutions and the adjusted averages after controlling for covariation of the variables listed in the table[3]

	Unadjusted average	Adjusted average[4]	LS coefficient[5]	Standard error[6]
Total	115.5	115.5	98.4	2.9
Socioeconomic status as of 1980				
Bottom quartile	94.0*	102.4*	-11.2	3.4
Middle quartiles	*111.7*	*113.5*	(7)	(7)
Top quartile	121.5*	118.8*	5.3	1.7
1982 cognitive test score				
Bottom quartile	85.6*	98.5*	-12.8	5.3
Middle quartiles	*105.6*	*111.3*	(7)	(7)
Top quartile	121.2*	118.2*	6.9	2.0
Rigorous high school curriculum[8]				
Did not meet criteria	*114.3*	*115.6*	(7)	(7)
Met criteria	117.6	115.4	-0.3	1.7
Time between high school and postsecondary education				
Less than 1 year	*117.9*	*115.6*	(7)	(7)
1 year or more	105.4*	114.3	-1.3	3.9
First institution control				
Public	*114.4*	*115.6*	(7)	(7)
Private, not-for-profit	118.9*	115.4	-0.2	1.8
First institution offering				
Nondoctorate-granting	*113.6*	*114.6*	(7)	(7)
Doctorate-granting	118.5*	116.6	2.0	1.7
Credits attempted in first term				
Fewer than 12	110.9*	111.1*	-6.4	1.9
12 or more	*118.2*	*117.6*	(7)	(7)
First-year grade point average				
Less than 2.0	88.2*	98.7*	-22.1	2.9
2.0–2.49	111.7*	113.0*	-7.8	2.2
2.5 or higher	*124.7*	*120.8*	(7)	(7)
First-year credit production				
Fewer than 30 credits	*106.0*	*110.6*	(7)	(7)
30 credits or more	127.7*	121.9*	11.4	2.0
Enrollment continuity				
Continuous enrollment[9]	*120.0*	*118.2*	(7)	(7)
Interrupted enrollment	96.0*	104.0*	-14.1	2.3

Table 9—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, the average number of credits completed[2] at qualifying institutions and the adjusted averages after controlling for covariation of the variables listed in the table[3]—Continued

	Unadjusted average	Adjusted average[4]	LS coefficient[5]	Standard error[6]
Summer term enrollment				
None	*101.5*	*100.2*	([7])	([7])
1 or more	123.6*	124.4*	24.2	1.8
Credits by examination				
Did not receive	*115.2*	*115.7*	([7])	([7])
Received	123.6*	111.9	-3.7	4.1

*$p \leq .05$.

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[3]The italicized group in each category is the reference group for comparisons.

[4]Adjusted for differences associated with other variables in the table (see appendix C).

[5]Least squares regression coefficient (see appendix C).

[6]Standard error of LS coefficient, adjusted for design effect (see appendix C).

[7]Not applicable for the reference group.

[8]This variable is included because of its relationship to first-year credit production (table 1).

[9]Includes a small number of cases for whom continuity could not be determined.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

The results indicate that several of the conclusions one would reach on the basis of simple crosstabulation are not affected by the adjustment procedure:

- Relative to middle SES students, low SES students averaged fewer credits and high SES students averaged more credits.
- Relative to students who scored in the middle quartiles of the HS&B cognitive test, students with lower scores averaged fewer credits and those with higher scores averaged more credits.
- Students who attempted fewer than 12 credits in the first term completed fewer credits overall than those who attempted at least 12 credits in the first term.
- Students whose first-year GPA was below 2.5 averaged fewer credits than did those with higher first-year grades.
- Students who completed at least 30 credits in the first year averaged more credits overall than students who completed fewer than 30 credits in the first year.

- Students who interrupted their enrollment completed fewer credits than those who were continuously enrolled.
- Students who enrolled for at least one summer term averaged more credits than students who did not enroll in the summer.

This does not mean that the adjustment procedure does not inform our understanding of how these characteristics are related to credit production. Rather, it shows that each of the above factors is independently related to credit production (with respect to the other variables in the table).[45] For example, first-year grades make a difference over and above a student's test scores, high school preparation (as measured here), and the other variables in the model. In addition, a student's socioeconomic background makes a difference over and above test scores, high school preparation, first-year achievement, and so on.

Several other conclusions *do* change as a result of this analysis. After controlling for the other variables in the model:

- Delayed entry into postsecondary education is not independently related to credit production. The other variables in table 9 account for the smaller number of credits completed by students who delayed their enrollment.
- Control and highest offering of the first institution are unrelated to credit production. This result is a departure from the simple descriptive findings throughout this report, especially with respect to control. What this suggests is that the observed differences in credit production between types of institutions reflect differences in the students themselves (such as SES, high school preparation, test scores, part-time enrollment, and first-year achievement), rather than differences related to the institutions attended.[46]
- Receiving credits by examination is not independently related to credit production. Students who received credits by examination differ in other respects that are captured by other variables in the table (such as family background, test scores, high school preparation, and first-year achievement), and when the influence of these characteristics is held constant, there is no evidence that students with examination credits complete more credits than those who did not receive such credits.

[45]However, there is always the possibility that other important variables have been omitted from the model.

[46]A more complicated possibility is that certain factors (such as first-year grades) *mediate* the influence of institutional characteristics. For example, to the extent that classes are larger at public (or nondoctorate-granting) institutions and students receive less individual attention from faculty, and these factors cause some students to earn lower grades than they would earn at private (or doctorate-granting) institutions, this institutional factor manifests itself through students' grades.

Summary and Conclusions

This study has shown that a number of characteristics and outcomes in the first academic year have important implications for students' long-term credit production and degree attainment. First-year credit production was positively related to long-term credit production and degree attainment. In addition, first-year academic performance was positively related to first-year credit production, reaching credit thresholds, time to degree as measured by time to credit thresholds, overall credit production, and degree attainment. Students who enrolled for fewer than 12 credits in the first term averaged fewer credits overall and were less likely to have completed the degree. Among students who interrupted their enrollment, those who interrupted before the second year were at greater risk for attrition than those who persisted into the second year and subsequently interrupted.

This study also demonstrates the utility of examining time to degree as a dynamic process, by examining the percentage of students achieving successive credit thresholds (using a 120-credit criterion as a proxy for degree completion). The percentage on a 4-year pace is highest at the 30-credit threshold (43 percent), and then relatively stable at 36–38 percent for subsequent thresholds. At the individual level, however, an appreciable number of students increase or decrease their pace from one threshold to the next.

The number of credits completed by bachelor's degree attainers was found to vary considerably with students' paths to the degree (both with respect to institutions attended and intermediate degrees) and major field of study. Students who attended less-than-4-year institutions completed more credits, as did students who completed an associate's degree and then a bachelor's degree. Students who majored in engineering and architecture and those who majored in health sciences and services completed more credits than the average bachelor's degree attainer.

Multivariate analysis of credit production revealed that SES, test scores, and first-year academic performance (among other factors) appear to be independently related to credit production. Lower overall credit production by students from lower socioeconomic backgrounds may reflect differences in first-generation college attendance status, as well as differences in family

resources.[47] Part-time enrollment in the first term is negatively related to long-term credit production net of first-year credit production and other variables.

When student and enrollment characteristics are held constant, students who began at public and at private, not-for-profit institutions earned comparable numbers of credits. Thus, apparent differences in credit production for the two groups appear to reflect differences in the students who enroll at the two types of institutions rather than inherent differences between the institutions themselves.

[47]For example, an analysis of students who began postsecondary education in 1989–90 found that low SES students accounted for 23 percent of students whose parents had not attended college, compared with 5 percent of students whose parents had done so (Anne-Marie Nuñez and Stephanie Cuccaro-Alamin, *First-Generation Students: Undergraduates Whose Parents Never Enrolled in Postsecondary Education* (NCES 98–082) (Washington D.C.: U.S. Department of Education, National Center for Education Statistics, 1998). This analysis also found that first-generation students who began at 4-year institutions persisted at lower rates than their counterparts whose parents had attended college.

Appendix A—Reference Tables

This appendix contains tables that the reader may find helpful. Table A1 illustrates the 10-credit criterion used for inclusion in the analysis, and shows how that criterion resulted in different rates of inclusion for different subgroups. (For details on how the analysis sample was defined, see the Introduction.) Table A2 shows where students in the analysis began their postsecondary education. Table A3 shows percentage distributions of selected variables that appear as rows elsewhere in the report, and presents them separately by type of institution first attended.

Table A1—Among 1982 high school graduates who expected at least a bachelor's degree and began at a 4-year institution, percentage distribution according to the number of credits completed[1] at qualifying institutions[2] by 1993

	Fewer than 10 credits[3]	10 credits or more
Total	3.5	96.5
Socioeconomic status as of 1980		
Bottom quartile	14.7	85.3
Middle quartiles	3.7	96.3
Top quartile	1.5	98.5
1982 cognitive test score		
Bottom quartile	14.0	86.0
Middle quartiles	7.0	93.0
Top quartile	1.3	98.7
Time between high school and postsecondary education		
Less than 1 year	2.7	97.3
1 year or more	10.1	89.9
Rigorous high school curriculum		
Did not meet criteria	4.0	96.0
Met criteria	1.7	98.3
First institution type		
Public	4.4	95.7
Nondoctorate-granting	7.5	92.5
Doctorate-granting	1.6	98.4
Private, not-for-profit	1.7	98.3
Nondoctorate-granting	2.0	98.0
Doctorate-granting	0.7	99.3
Enrollment continuity		
Continuous enrollment	0.1	99.9
Interrupted enrollment	3.7	96.4
First-year grade point average		
Less than 2.0	11.5	88.5
2.0–2.49	2.6	97.4
2.5–2.99	0.7	99.3
3.0–3.49	0.2	99.8
3.5 or higher	2.4	97.6

[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[3]Includes students who did not enroll at qualifying institutions.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Table A2—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits[1] at qualifying institutions[2] by September 1993, percentage distribution according to type of institution first attended, by selected student and enrollment characteristics

	Public		Private, not-for-profit	
	Nondoctorate-granting	Doctorate-granting	Nondoctorate-granting	Doctorate-granting
Total	29.8	37.1	23.6	9.6
Socioeconomic status as of 1980				
Bottom quartile	49.8	29.1	15.8	5.3
Middle quartiles	36.4	34.5	23.4	5.7
Top quartile	22.1	40.2	24.7	13.0
1982 cognitive test score				
Bottom quartile	56.9	20.9	22.1	0.1
Middle quartiles	41.2	32.4	22.5	3.9
Top quartile	23.8	40.2	23.7	12.3
Rigorous high school curriculum[3]				
Did not meet criteria	30.0	37.5	23.7	8.8
Met criteria	28.9	34.6	25.1	11.5
Time between high school and postsecondary education[3]				
Less than 1 year	29.6	37.6	23.4	9.4
1 year or more	33.2	31.8	23.5	11.4
Credits attempted in first term				
Fewer than 12	28.0	47.9	17.5	6.5
12 or more	30.6	32.4	26.3	10.8

[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[3]Because this variable was not available for all students, the total percentage includes some students who are not included in subgroup percentages.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Table A3—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits[1] at qualifying institutions[2] by September 1993, percentage distribution (in columns) according to selected student and enrollment characteristics, by type of institution first attended

		Public			Private, not-for-profit		
	Total	Total	Non-doctorate-granting	Doctorate-granting	Total	Non-doctorate-granting	Doctorate-granting
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Socioeconomic status as of 1980							
Bottom quartile	6.9	8.1	11.4	5.4	4.4	4.6	3.8
Middle quartiles	41.0	43.3	49.9	38.0	36.0	40.6	24.6
Top quartile	52.2	48.6	38.7	56.6	59.6	54.8	71.6
1982 cognitive test score							
Bottom quartile	2.8	3.2	5.2	1.5	1.9	2.6	0[3]
Middle quartiles	30.8	33.6	42.2	26.8	24.8	29.7	12.7
Top quartile	66.4	63.2	52.6	71.7	73.3	67.7	87.3
Rigorous high school curriculum							
Did not meet criteria	69.6	70.8	70.3	71.2	67.0	68.3	63.8
Met criteria	30.4	29.2	29.7	28.8	33.0	31.8	36.2
Time between high school and postsecondary education							
Less than 1 year	95.3	95.7	95.1	96.3	95.3	95.6	94.7
1 year or more	4.7	4.3	4.9	3.7	4.7	4.4	5.3
Credits attempted in first term							
Fewer than 12	30.5	34.5	28.5	39.2	22.0	22.5	20.8
12 or more	69.5	65.5	71.5	60.8	78.0	77.5	79.2
First-year grade point average							
Less than 2.0	14.7	16.4	17.4	15.6	11.2	12.2	8.9
2.0–2.49	25.8	27.4	29.2	25.9	22.9	23.2	21.9
2.5–2.99	28.7	28.6	27.3	29.7	29.1	30.3	26.1
3.0–3.49	20.6	18.7	17.8	19.5	24.3	21.6	30.8
3.5 or higher	10.2	8.9	8.3	9.3	12.6	12.7	12.3
Enrollment continuity							
Continuous enrollment	81.2	79.1	80.3	78.1	86.0	85.9	86.1
Interrupted enrollment	18.8	20.9	19.7	21.9	14.0	14.1	13.9
Timing of enrollment interruption[4]							
Year 1	28.7	26.9	30.3	24.4	31.8	29.8	36.7
Year 2	25.3	23.6	24.0	23.3	30.7	34.2	22.2
Year 3 or later	37.2	40.6	41.0	40.3	28.6	25.3	36.4
After last qualifying term (any year)	3.7	3.8	1.2	5.7	3.4	3.7	2.7
Not at qualifying institution	5.1	5.1	3.5	6.3	5.5	7.0	1.9

Table A3—Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits[1] at qualifying institutions[2] by September 1993, percentage distribution (in columns) according to selected student and enrollment characteristics, by type of institution first attended—Continued

		Public			Private, not-for-profit		
	Total	Total	Non-doctorate-granting	Doctorate-granting	Total	Non-doctorate-granting	Doctorate-granting
Month began postsecondary education[5]							
Early start (June–July)	5.2	5.5	5.7	5.3	4.0	3.4	5.4
Regular start (August–October)	91.5	91.6	90.3	92.6	92.1	91.8	92.8
Late start (November–May)	3.4	2.9	4.0	2.0	3.9	4.7	1.8
Summer term enrollment							
None	36.6	34.9	39.3	31.4	40.4	41.5	37.8
1 or more	63.4	65.1	60.7	68.6	59.6	58.5	62.2
Highest degree as of 1993							
None	20.6	23.0	28.5	18.6	16.0	18.2	10.5
Certificate	0.7	1.0	0.8	1.2	0.1	0[3]	0.2
Associate's	2.5	3.0	3.4	2.6	1.1	1.2	1.0
Bachelor's or higher	76.3	73.1	67.4	77.7	82.8	80.6	88.3

[1]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

[2]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[3]Values of 0.0 are less than 0.05.

[4]Enrolled time (only years with enrollment are counted).

[5]Because the column variable was not available for all students, the total percentage includes some students who are not included in subgroup percentages.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Appendix B—Glossary

This glossary describes the variables used in this report. The items were taken directly from the NCES HS&B:80/92 Data Analysis System (DAS), an NCES software application that generates tables from the HS&B data (see appendix C for a description of the DAS). The variables listed in the index below are organized by sections in the order they appear in the report; the glossary is in alphabetical order by variable name (displayed along the right-hand column). The last section contains variables that do not appear in tables but that were used to restrict the analysis sample (see text).

Glossary Index

STUDENT CHARACTERISTICS

Socioeconomic status as of 1980 ..... SESQ
1982 cognitive test score..... SRTESTQ

ENROLLMENT CHARACTERISTICS

Rigorous high school curriculum NWBASIC4
Time between high school and post-secondary education.....MONSTRT
Month began postsecondary education ..... TRUMO
First institution type .....TRUSECT
Combination of institutions attended INSTCOM3
Credits attempted in first term..... CREDATT1
First year grade point average.....UG1GPA
First-year credit production.....CRATEFST
Credits completed at qualifying institutions.....CREDSCMP
Credits completed at 2-year institutions.....CREDS2
Credits completed at 4-year institutions.....CREDS4
Credits by examination .....CREDSEX
Year when earned 30th credit N30
Year when earned 60th credit N60
Year when earned 90th credit N90
Year when earned 120th credit N120
Highest degree as of 1993..... DEGREE93
Combination of postsecondary awards ...: DEGCOMB
Enrollment continuity .....CONTIN
Timing of enrollment interruption.....GAPTYPE
Summer term enrollment..... SUMMERS
Number of credits completed and bachelor's degree attainment .....CDEGCMP
Number of months to bachelor's degree ..... TIMEBA
Major field MAJCOD6

VARIABLES USED TO DEFINE THE ANALYSIS SAMPLE

High school graduate ..... HSGRAD
Educational expectations as of 1982 ..... EDASP82
Ten or more credits at qualifying institutions.....CRSAMP
First institution level TRIFA3

Number of credits completed and bachelor's degree attainment **CDEGCMP**

Combines degree attainment with the number of semester credits completed at qualifying institutions (2- or 4-year institutions with Carnegie Classification 11–59). Excludes credits by examination, transfer credits not earned at qualifying institutions, courses taken while in high school, courses on GED-level transcripts, clock-hour courses, and graduate level courses. Number of credits is rounded to the nearest tenth.

Fewer than 60 credits	Includes certificate completers and a small number of students whose transcripts indicate a degree.
60 credits or more, no bachelor's degree	Includes certificate completers.
60 or more, received bachelor's degree	Includes certificate and associate's degree completers.

Enrollment continuity **CONTIN**

Continuity of enrollment in postsecondary education. If there was a gap of two or more semesters (or three or more quarters) in term dates, then student enrollment was deemed noncontinuous.

Continuous enrollment
Interrupted enrollment

First-year credit production **CRATEFST**

Number of credits completed at qualifying institutions in the first academic year, rounded to the nearest tenth. Excludes credits by examination, transfer credits not earned at qualifying institutions, courses taken while in high school, courses on GED-level transcripts, clock-hour courses, and graduate level courses.

Fewer than 20
20–29.9
30 or more

Credits attempted in first term **CREDATT1**

Number of credits attempted in first term at qualifying institutions, rounded to the nearest tenth. Semester credits in graded or pass/no credit courses, penalty withdrawals included. Excludes credits by examination, transfer credits not earned at qualifying institutions, courses taken while in high school, courses on GED-level transcripts, clock-hour courses, and graduate level courses. Limited to 1 institution. If a student attended more than 1 institution in the first term, the one with the most credits was used.

Fewer than 12
12 or more

Credits completed at 2-year institutions **CREDS2**

Sum of all semester credits for coursework completed at qualifying 2-year institutions, rounded to the nearest tenth. Excludes credits by examination, transfer credits not earned at qualifying institutions, courses taken while in high school, courses on GED-level transcripts, clock-hour courses, and graduate level courses.

Credits completed at 4-year institutions **CREDS4**

Sum of all semester credits for coursework completed at qualifying 4-year institutions, rounded to the nearest tenth. Excludes credits by examination, transfer credits not earned at qualifying institutions, courses taken while in high school, courses on GED-level transcripts, clock-hour courses, and graduate level courses.

Credits completed at qualifying institutions **CREDSCMP**

Sum of semester credits for coursework completed at qualifying institutions (see CRSAMP), rounded to the nearest tenth. Excludes credits by examination, transfer credits not earned at qualifying institutions, courses taken while in high school, courses on GED-level transcripts, clock-hour courses, and graduate level courses.

Credits by examination **CREDSEX**

Sum of semester credits awarded by examination at qualifying institutions, rounded to the nearest tenth.

Ten or more credits at qualifying institutions **CRSAMP**

Identifies students included in credit production analysis. Used to filter tables A2 and A3 for comparability with other tables in the report. Identifies students who attended qualifying institutions (2- or 4-year institutions with Carnegie Classification 11–59) and who had completed at least 10 credits at such institutions by September 1993 (excluding credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree).

NOTE: This variable does not restrict the sample with respect to high school graduation status or educational expectations.

Combination of postsecondary awards **DEGCOMB**

Combination of undergraduate degrees as shown on transcripts. This variable was only used in a table limited to bachelor's degree completers.

Associate's, then bachelor's	Includes certificate completers.
Bachelor's, no prior associate's	Includes certificate completers and any students who completed an associate's degree *after* the bachelor's degree.

Highest degree as of 1993 **DEGREE93**

Highest degree attained by September 1993, based on transcripts.

None
Certificate
Associate's
Bachelor's or higher

Educational expectations as of 1982 **EDASP82**

Self-reported educational expectations from the first follow-up survey (1982). Students were asked, "As things stand now, how far in school do you think you will get?" Used in combination with HSGRAD to select the analysis sample (high school graduates who expected to attain a bachelor's degree or higher).

Timing of enrollment interruption **GAPTYPE**

For students who interrupted their enrollment at a qualifying institution, timing of the interruption relative to academic year of enrollment (term start dates of June–May defined as an academic year). Year of interruption is the last year of enrollment before the interruption (that is, the interruption occurred during or immediately after the year indicated). Years refer to enrolled time (only years with enrollment are counted). For some cases, the interruption identified by CONTIN preceded the first or followed the last term at a qualifying institution. These cases were excluded from analysis.

Year 1	Interruption during or immediately after the first academic year of enrollment at a qualifying institution, followed by a return to a qualifying institution.
Year 2	Interruption during or immediately after the second academic year of enrollment at a qualifying institution, followed by a return to a qualifying institution.
Year 3 or later	Interruption during or immediately after the third academic year of enrollment or later at a qualifying institution, followed by a return to a qualifying institution.
After last qualifying term (any year)	Interruption followed the last term at a qualifying institution.
Not at qualifying institution	Not enrolled at a qualifying institution at the time of the interruption.

High school graduate **HSGRAD**

Self-reported high school completion status. Used in combination with EDASP82 to select the analysis sample (high school graduates who expected to attain a bachelor's degree or higher).

Combination of institutions attended **INSTCOM3**

Derived from review of all transcripts requested, uniform versions of transcripts received (with particular attention to term dates), and fourth follow-up survey data when there were questions about the order of attendance. Modified from PETS variable INSTCOMB, with conflicting information resolved by inspecting transcripts.

4-year institution(s) only
All other combinations

Major field **MAJCOD6**

Major as shown on transcript for highest undergraduate degree, aggregated using the scheme in Clifford Adelman, *The New College Course Map and Transcript Files* (Washington D.C.: U.S. Department of Education, 1995). Right-hand column indicates the major field classifications that were aggregated. Not all majors listed appear on transcripts.

Business	Accounting, Finance, Operations research, Business administration/management, Human resource development/personnel or labor management, Marketing and distribution, Retail/merchandising, Hospitality management.
Education and library science	Early childhood education, Elementary education, Secondary and junior high school education, Special education, Physical and health education, All other education, Library or archival science.
Engineering/Engineering technology/Architecture	Architecture or environmental design, Electrical or commercial engineering, Chemical engineering, Civil/ocean engineering, Mechanical engineering, Other engineering, Computer engineering, Engineering technology, Electrical engineering technology.
Physical sciences	Chemistry, Geology/earth sciences, Physics, Other physical science.
Mathematics/Computer science	Computer programming, Information management, Computer and information science, All other math.
Life and agricultural sciences	Agriculture/animal or plant science, Natural resources and conservation, Forestry/forest production, Biochemistry or bio-physics, All other biological sciences, Environmental science, Biopsychology or psychobiology.
Health sciences and services	Dental/medical technician, Physical or other therapies, Health/physical education/recreation, Practical nursing, Allied health: general and other, Radiologic technician, Speech pathology or audiology, Clinical health sciences, Nursing, Health/hospital administration, Public health, Other health sciences, Nutrition/food science.
Humanities	Foreign language, English or American literature, Creative and technical writing, All other letters, Interdisciplinary humanities, Philosophy, Religious studies.
Arts/Applied arts	Graphic or industrial design, Drama, Speech, Film arts, Music, Fine art/art history, Fine and performing art.
Social sciences	American civilization/studies, Area studies, Ethnic studies, Paralegal/pre-law, Law, Women's studies, General social science, Psychology, Anthropology/Archaelogy, Economics, Geography, History, Sociology/demography or crime studies, Political science, International relations/studies.

Applied social sciences	Agribusiness and production, Print or broadcast journalism, Communications, Textiles/fashion, Home economics: other, Recreation, sports, Criminal justice/police training, Social work or social service, Other public administration.
Other	Secretarial/clerical, Other business support, Communication technology, Cosmetology/hair styling, Other consumer services, Child care/guidance, Vocational home economics, Liberal or general studies, Military science and technology, Integrated/general science, Basic/personal skills, Theology, Fire science, Construction or industrial arts, Auto or airplane mechanics, Electronic mechanics and repair, Air conditioning or heating mechanics, All other mechanics, Graphic/printing, Precision production, Air transportation, Other transportation.
Combination	Transcript shows more than one major field. This could indicate a minor, a double major, or some other combination of fields.

Time between high school and postsecondary education **MONSTRT**

Number of months between high school graduation and first postsecondary attendance.

Less than 1 year
1 year or more

Year when earned 120th credit **N120**

Number of academic years enrolled through the year in which a student completed the 120th credit (as defined for CREDSCMP). Only years with enrollment at qualifying institutions are counted (that is, this is a measure of enrolled time, not elapsed time).

Fourth year or earlier
Fifth year
Sixth year or later

Year when earned 30th credit **N30**

Number of academic years enrolled through the year in which a student completed the 30th credit (as defined for CREDSCMP). Only years with enrollment at qualifying institutions are counted (that is, this is a measure of enrolled time, not elapsed time).

First year
Second year
Third year or later

Year when earned 60th credit **N60**

Number of academic years enrolled through the year in which a student completed the 60th credit (as defined for CREDSCMP). Only years with enrollment at qualifying institutions are counted (that is, this is a measure of enrolled time, not elapsed time).

Second year or earlier
Third year
Fourth year or later

Year when earned 90th credit **N90**

Number of academic years enrolled through the year in which a student completed the 90th credit (as defined for CREDSCMP). Only years with enrollment at qualifying institutions are counted (that is, this is a measure of enrolled time, not elapsed time).

Third year or earlier
Fourth year
Fifth year or later

Rigorous high school curriculum **NWBASIC4**

Identifies students whose high school transcript indicates at least four Carnegie units of English and at least three Carnegie units each of mathematics, science, and social studies.

Did not meet criteria
Met criteria

Socioeconomic status as of 1980 **SESQ**

Quartile rank on a continuous variable derived from the base year survey questions about parents' education, income, and items in the home. Quartile rank is relative to the entire cohort (not the analysis sample).

Bottom quartile
Middle quartiles
Top quartile

1982 cognitive test score **SRTESTQ**

Quartile rank on mathematics, reading, and vocabulary subtests of the first follow-up (1982) cognitive test battery. Quartile rank is relative to the entire cohort (not the analysis sample).

Bottom quartile
Middle quartiles
Top quartile

Summer term enrollment **SUMMERS**

Number of summer terms recorded on transcripts, defined as terms starting in June or July.

None
1 or more

Number of months to bachelor's degree **TIMEBA**

Number of months between the date of first enrollment and the date the bachelor's degree was awarded, as shown on transcripts. NOTE: This is a measure of elapsed time, not enrolled time.

First institution level **TRIFA3**

Carnegie classification of first institution attended, derived from reading uniform versions of transcripts. The determination of "true institution of first attendance" excludes course taking in postsecondary institutions while students are still enrolled in high school, initial terms of attendance for which the record shows nothing but withdrawals and drops, and (unless it is the student's only record) attendance consisting of only one or two courses. This variable was used to restrict the analysis sample to students who first enrolled at a research university, doctorate-granting institution, comprehensive university, or liberal arts college.

Month began postsecondary education **TRUMO**

Month component of date began postsecondary education (PETS variable TRUDATE). Date computation excludes enrollment while in high school, initial terms of attendance for which the record shows nothing but withdrawals and drops, and (unless it is the student's only record) attendance consisting of only one or two courses.

Early start (June–July)
Late start (November–May)
Regular start (August–October)

First institution type **TRUSECT**

Control and highest offering of first institution attended. The determination of "true institution of first attendance" excludes course taking in postsecondary institutions while students are still enrolled in high school, initial terms of attendance for which the record shows nothing but withdrawals and drops, and (unless it is the student's only record) attendance consisting of only one or two courses.

Public	An institution supported primarily by public funds and operated by publicly elected or appointed officials.
Public nondoctorate-granting	Public 4-year institution not offering doctoral degrees.
Public doctorate-granting	Public 4-year institution offering doctoral degrees.

Private, not-for-profit	An institution controlled by an independent governing board and incorporated under section 503(c) (3) of the Internal Revenue Code.
Private, not-for-profit nondoctorate-granting	Independent 4-year institution not offering doctoral degrees.
Private, not-for-profit doctorate-granting	Independent 4-year institution offering doctoral degrees.

NOTES: There were no students in the analysis sample who first enrolled at a private, for-profit 4-year institution. One table includes estimates for public and private, not-for-profit 4-year institutions that were aggregated over highest offering. One table includes students who began at a less-than-4-year institution, and includes the category Public 2-year.

First-year grade point average **UG1GPA**

Grade point average (GPA) for courses taken in the first academic year of postsecondary education. First academic year defined as all terms across all institutions with start months between TRUMO and the following May (inclusive). Excludes noncredit courses, courses on GED-level transcripts, pass/fail courses, and courses credited by examination or transfer.

Less than 2.0
2.0–2.49
2.5–2.99
3.0–3.49
3.5 or higher

Appendix C—Technical Notes and Methodology

The High School and Beyond Fourth Follow-up Study

High School and Beyond (HS&B) is a longitudinal study that followed two cohorts of students. It began with a nationally representative sample of over 58,000 students who were high school sophomores and seniors in 1980. An extensive survey was administered in the base year along with a battery of cognitive tests. Both cohorts were followed up at 2-year intervals through 1986, and the sophomore cohort was followed up a fourth time in 1992. Cognitive tests were administered to the sophomore cohort during the first follow-up survey, when most were high school seniors. In addition, high school transcripts were collected and coded. The fourth follow-up included a collection of postsecondary transcripts for members of the sophomore cohort who had continued their education beyond high school. The HS&B Postsecondary Education Transcript Study (PETS) includes transcript information to September 1993.[48]

Sample weights. All analyses in this report are weighted to compensate for unequal probability of selection into the HS&B sample and to adjust for nonresponse. Because this report relies extensively on PETS data and requires complete information on postsecondary course taking, all analyses were weighted to select students for whom complete transcript information was available (weight variable PSEWT3).

Accuracy of Estimates

The statistics in this report are estimates derived from a sample. Two broad categories of error occur in such estimates: sampling and nonsampling errors. Sampling errors occur because observations are made only on samples of students, not on entire populations. Nonsampling errors occur not only in sample surveys but also in complete censuses of entire populations. Nonsampling errors can be attributed to a number of sources: inability to obtain complete information about all students in all institutions in the sample (some students or institutions refused to participate, or students participated but answered only certain items); ambiguous definitions;

[48]For details on the HS&B fourth follow-up, see D. Zahs, S. Pedlow, M. Morrissey, P. Marnell, and B. Nichols, *High School and Beyond Fourth Follow-up Methodology Report* (Washington, D.C.: U.S. Department of Education, 1994). For details on the PETS data, see Clifford Adelman, *The New College Course Map and Transcript Files* (Washington, D.C.: U.S. Department of Education, 1995).

differences in interpreting questions; inability or unwillingness to give correct information; mistakes in recording or coding data; and other errors of collecting, processing, sampling, and imputing missing data.

Data Analysis System

The estimates presented in this report were produced using the HS&B:80/92 Data Analysis System (DAS). The DAS software makes it possible for users to specify and generate their own tables from the HS&B:80/92 data. With the DAS, users can replicate or expand upon the tables presented in this report. In addition to the table estimates, the DAS calculates proper standard errors[49] and weighted sample sizes for these estimates. For example, table C1 contains standard errors that correspond to table 1 in the text, and was generated by the DAS. If the number of valid cases is too small to produce a reliable estimate (fewer than 30 cases), the DAS prints the message "low N" instead of the estimate.

All variables in the DAS are integers. To preserve decimal precision for certain variables, values in the DAS have been multiplied by a factor of 10. For example, grade point averages range from 0–400 in the DAS. When averages for such variables appear in this report, estimates and standard errors were divided by the appropriate factor of 10 to restore the original scale.

In addition to tables, the DAS will also produce a correlation matrix of selected variables to be used for linear regression models. Included in the output with the correlation matrix are the design effects (DEFTs) for each variable in the matrix. Since statistical procedures generally compute standard errors based on an assumption of simple random sampling, the standard errors must be adjusted with the design effects to take into account HS&B's complex sample design. (See discussion under "Statistical Procedures" below for the adjustment procedure.)

For more information about the HS&B:80/92 and other Data Analysis Systems, consult the NCES DAS website (www.nces.ed.gov/das) or its West Coast mirror site (www.pedar-das.org), or contact:

Aurora D'Amico
NCES Data Development and Longitudinal Studies Group
555 New Jersey Avenue, NW
Washington, DC 20208-5652
(202) 219-1365
Internet address: Adamico@inet.ed.gov

[49]The HS&B sample is not a simple random sample and, therefore, simple random sample techniques for estimating sampling error cannot be applied to these data. The DAS takes into account the complexity of the sampling procedures and calculates standard errors appropriate for such samples. The method for computing sampling errors used by the DAS involves approximating the estimator by the linear terms of a Taylor series expansion. The procedure is typically referred to as the Taylor series method.

Table C1—Standard errors corresponding to table 1: Among 1982 high school graduates who expected at least a bachelor's degree, began at a 4-year institution, and had completed at least 10 credits at qualifying institutions[1] by September 1993, percentage distribution according to number of credits completed[2] in the first year and the average number of credits, by selected student and enrollment characteristics

	First-year credit production			Average number of credits in first year
	Fewer than 20	20–29.9	30 or more	
Total	0.92	1.21	1.20	0.19
Socioeconomic status as of 1980				
Bottom quartile	3.73	4.72	4.00	0.65
Middle quartiles	1.59	1.89	1.92	0.33
Top quartile	1.07	1.68	1.63	0.22
1982 cognitive test score				
Bottom quartile	7.63	7.40	5.92	1.22
Middle quartiles	1.62	2.23	2.10	0.31
Top quartile	1.04	1.41	1.50	0.24
Rigorous high school curriculum				
Did not meet criteria	1.16	1.48	1.50	0.25
Met criteria	1.39	2.22	2.24	0.30
Time between high school and postsecondary education				
Less than 1 year	0.92	1.31	1.29	0.19
1 year or more	5.46	6.04	5.34	1.05
Month began postsecondary education				
Early start (June–July)	3.27	4.67	5.10	0.99
Regular start (August–October)	0.88	1.25	1.25	0.18
Late start (November–May)	6.24	6.24	0.65	0.89
First institution type				
Public	1.13	1.49	1.52	0.24
Nondoctorate-granting	1.55	2.21	2.21	0.32
Doctorate-granting	1.62	2.00	2.06	0.34
Private, not-for-profit	1.28	1.97	2.01	0.28
Nondoctorate-granting	1.67	2.30	2.45	0.35
Doctorate-granting	2.02	3.69	3.69	0.49
Credits attempted in first term				
Fewer than 12	2.06	2.17	2.13	0.44
12 or more	0.85	1.45	1.45	0.18
First-year grade point average				
Less than 2.0	3.11	3.13	1.63	0.46
2.0–2.49	1.71	2.56	2.40	0.33
2.5–2.99	1.47	2.35	2.40	0.32
3.0–3.49	1.53	2.60	2.66	0.36
3.5 or higher	2.47	2.64	3.26	0.66
Average number of credits in first year	0.29	0.11	0.11	0.19

[1]Includes 2- and 4-year institutions (Carnegie classifications 11–41), plus selected specialized institutions that offer bachelor's degrees or coursework creditable toward a bachelor's degree (Carnegie classifications 51–59).

[2]Excludes credits completed while in high school, credits on GED-level transcripts, credits by examination, credits at nonqualifying institutions, credit equivalents for clock-hour courses, and credits completed after the bachelor's degree.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980–92 High School & Beyond Longitudinal Study (HS&B), Sophomore Cohort, Data Analysis System.

Statistical Procedures

Three types of statistical procedures were employed in this report: testing differences between means (or proportions), testing for linear trends, and adjustment of means after controlling for covariation among several variables. Each procedure is described below.

Differences Between Means

Most descriptive comparisons in this report were tested using Student's *t* statistic. Statistical significance was determined by calculating *t* values for differences between pairs of means or proportions and comparing these with published values of *t* for two-tailed hypothesis testing, using a 5 percent probability of a Type I error (a significance level of .05).[50]

Student's *t* values may be computed to test the difference between estimates with the following formula:

$$t = \frac{E_1 - E_2}{\sqrt{se_1^2 + se_2^2}} \qquad (1)$$

where E_1 and E_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors. Note that this formula is valid only for independent estimates. When the estimates are not independent (for example, when comparing a total percentage with that for a subgroup that is included in the total), a covariance term must be added to the denominator of the *t*-test formula. When comparing the estimate for a total with that of a subgroup, the following formula was used:

$$t = \frac{E_{sub} - E_{tot}}{\sqrt{se_{sub}^2 + se_{tot}^2 - 2p\,se_{sub}^2}} \qquad (2)$$

where *p* is the proportion of the total contained in the subgroup.

There are hazards in reporting statistical tests for each comparison. First, comparisons based on large *t* statistics may appear to merit special attention. This can be misleading, since the magnitude of the *t* statistic is related not only to the observed differences in means or percentages but also to the number of students in the specific categories used for comparison. Hence, a small difference compared across a large number of students would produce a large *t* statistic.

[50] A Type I error occurs when one erroneously concludes that a difference observed in a sample reflects a true difference in the population from which the sample was drawn.

A second hazard in reporting statistical tests for each comparison occurs when making multiple comparisons among categories of an independent variable. For example, when making paired comparisons among different levels of income, the probability of a Type I error for these comparisons taken as a group is larger than the probability for a single comparison. When more than one difference between groups of related characteristics or "families" are tested for statistical significance, one must apply a standard that assures a level of significance for all of those comparisons taken together.

Comparisons were made in this report only when $p \leq .05/k$ for a particular pairwise comparison, where that comparison was one of k tests within a family. This guarantees both that the individual comparison would have $p \leq .05$ and that for k comparisons within a family of possible comparisons, the significance level for all the comparisons will sum to $p \leq .05$.[51]

For example, when comparing males and females only one comparison is possible. In this family, $k=1$, and there is no need to adjust the significance level. When students are divided into five racial–ethnic groups and all possible comparisons are made, then $k=10$ and the significance level for each test within this family of comparisons must be $p \leq .05/10$, or $p \leq .005$. The formula for calculating family size (k) is as follows:

$$k = \frac{j(j-1)}{2} \tag{3}$$

where j is the number of categories for the variable being tested. For example, in the case of a variable with five categories such as race–ethnicity, one substitutes 5 for j in equation 3:

$$k = \frac{5(5-1)}{2} = 10$$

Linear Trends

Some comparisons across categories of an ordered variable with three or more levels involved a test for a linear trend across all categories, rather than a series of tests between pairs of categories. Two procedures were used to test the statistical significance of an apparent linear trend, depending upon whether the estimates being examined were proportions (such as percentages) or averages.

---

[51]The standard that $p \leq .05/k$ for each comparison is more stringent than the criterion that the significance level of the comparisons should sum to $p \leq .05$. For tables showing the t statistic required to ensure that $p \leq .05/k$ for a particular family size and degrees of freedom, see Olive Jean Dunn, "Multiple Comparisons Among Means," *Journal of the American Statistical Association* 56 (1961): 52–64.

Linear trends in proportions. When proportions were examined relative to a variable with ordered categories, Student's *t*-test was applied to a measure of linear trend. The test involves estimating a simple linear regression with a variable representing the order of the categories as the independent variable (e.g., SES), and the proportion of interest (e.g., the percentage who completed at least 30 credits) as the dependent variable. Before estimating the regression, the data must be adjusted by design effects to account for the complex sample design. The *t* statistic is calculated as the ratio of the regression coefficient to its standard error. If *t* is greater than 1.96 (the critical value of *t* at a significance level of .05), there is evidence of a linear relationship between the two variables.[52]

Linear trends in averages. When averages of a continuous variable were examined relative to a variable with ordered categories, Analysis of Variance (ANOVA) was used to test for a linear relationship between the two variables. To do this, ANOVA models included orthogonal linear contrasts corresponding to successive levels of the independent variable. The squares of the Taylorized standard errors (that is, standard errors that were calculated by the Taylor series method), the variance between the means, and the unweighted sample sizes were used to partition total sum of squares into within- and between-group sums of squares. These were used to create mean squares for the within- and between-group variance components and their corresponding *F* statistics, which were then compared with published values of *F* for a significance level of .05.[53] Significant values of both the overall *F* and the *F* associated with the linear contrast term were required as evidence of a linear relationship between the two variables. Means and Taylorized standard errors were calculated by the DAS. Unweighted sample sizes are not available from the DAS and were provided by NCES.

Adjustment of Means to Control for Covariation Among Several Variables

Tabular results are limited by sample size when attempting to control for the multiplicity of factors that may account for the variation observed between two variables. For example, when examining the average number of credits completed, it is impossible to know to what extent the observed variation is due to socioeconomic status (SES) differences and to what extent it is due to differences in other factors related to SES, such as type of institution attended, intensity of enrollment, and so on. However, if a nested table were produced showing SES within type of institution attended, within enrollment intensity, the cell sizes would be too small to identify the

---

[52]For more information about this modification of Student's *t*-test, see George W. Snedecor and William G. Cochran, *Statistical Methods* (Ames, IA: Iowa State University Press, 1967), 246–247. For more information about linear regression, see Michael Lewis-Beck, *Applied Regression: An Introduction,* Vol. 22 (Beverly Hills, CA: Sage Publications, Inc., 1980).

[53]More information about ANOVA and significance testing using the *F* statistic can be found in any standard textbook on statistical methods in the social and behavioral sciences.

patterns. When the sample size becomes too small to support controls for another level of variation, one must use other methods to take such variation into account.

To overcome this difficulty, multiple linear regression was used to obtain means that were adjusted for covariation among a list of control variables.[54] Adjusted means for subgroups were obtained by regressing the dependent variable on a set of student and enrollment characteristics. Substituting ones or zeros for the subgroup characteristic(s) of interest and the mean proportions for the other variables results in an estimate of the adjusted mean for the specified subgroup, holding all other variables constant. For example, consider a hypothetical case in which two variables, race–ethnicity and SES, are used to describe an outcome, Y (such as the number of credits completed). The variables race–ethnicity and SES are recoded into dummy variables:

Race–ethnicity	R
Black, non-Hispanic	1
All others	0

and

SES	S
Low SES	1
All others	0

The following regression equation is then estimated from the correlation matrix output from the DAS:

$$\hat{Y} = a + b_1R + b_2S \qquad (4)$$

To estimate the adjusted mean for any subgroup evaluated at the mean of all other variables, one substitutes the appropriate values for that subgroup's dummy variables (1 or 0) and the mean for the dummy variable(s) representing all other subgroups. For example, suppose we had a case where Y was being described by race–ethnicity (R) and SES (S), coded as shown above, and the means for R and S are as follows:

[54]For more information about multiple regression, see Michael S. Lewis-Beck, *Applied Regression: An Introduction*, Vol. 22 (Beverly Hills, CA: Sage Publications, Inc., 1980), or William D. Berry and Stanley Feldman, *Multiple Regression in Practice*, Vol. 50 (Beverly Hills, CA: Sage Publications, Inc., 1987).

Variable	Mean
R	0.109
S	0.282

Suppose the regression equation results in:

$$\hat{Y} = 51.07 + (17.63)R + (-22.46)S$$

To estimate the adjusted value for black students, one substitutes the appropriate parameter values into equation 4.

Variable	Parameter	Value
a	51.07	—
R	17.63	1.000
S	-22.46	0.282

This results in:

$$\hat{Y} = 51.07 + (17.63)(1) + (-22.46)(0.282) = 62.37$$

In this case, the estimated mean number of credits is 62.37 and represents the expected outcome for non-Hispanic black students who resemble the average student with respect to the other variables in the model (in this example, SES).

It is relatively straightforward to produce a multivariate model using the DAS, since one of the DAS output options is a correlation matrix, computed using pairwise missing values and properly weighted to account for the complex sample design and for nonresponse.[55] This matrix can be used by most statistical software packages as the input data for least-squares regression. That is the approach used for this report, with an additional adjustment to incorporate the complex sample design into the statistical significance tests of the parameter estimates (described below).

Most statistical software packages assume simple random sampling when computing standard errors of parameter estimates. Because of HS&B's complex sample design, this assumption is incorrect. A better approximation of the standard errors is to multiply each standard error by

[55]Although the DAS enables the analyst to estimate regression models, it also limits the choices available. Analysts who wish to use other than pairwise treatment of missing values or to estimate other models can apply for a restricted data license from NCES.

the average design effect of the dependent variable (DEFT),[56] where the DEFT is the ratio of the true standard error to the standard error computed under the assumption of simple random sampling. It is calculated by the DAS and produced with the correlation matrix.

[56]The adjustment procedure and its limitations are described in C.J. Skinner, D. Holt, and T.M.F. Smith, eds., *Analysis of Complex Surveys* (New York: John Wiley & Sons, 1989).

65 ☆U.S. GOVERNMENT PRINTING OFFICE: 1999 - 449-278/10038

ISBN 0-16-049927-5

United States
Department of Education
Washington, DC 20208–5652

Official Business
Penalty for Private Use, $300

Postage and Fees Paid
U.S. Department of Education
Permit No. G–17

Standard Mail (A)